INDIA RUBBER WORLD

TECHNOLOGY DEPT.

OUR 64th YEAR

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For Outstanding Tread and Carcass Stocks

DU PONT 2-MT

You'll want to check the advantages manufacturers are getting in stocks accelerated with Du Pont 2-MT.

- **Exceptionally low heat build-up**
- **Excellent resistance to heat and aging**
- **Retention of tensile and tear strength at elevated temperatures**
- **Good resistance to flex-cracking**

These features mean a better, more flex-resistant tread stock and a better, cooler-running carcass stock. It means, too, that your product is protected from the ravages of heat deterioration should overheating occur. And this is important in tires that must stand up under rugged conditions—heavy-duty truck and bus tires, for example.

The properties of 2-MT suggest its use in other dynamic services, too. Products exposed to severe mechanical working, such as belts and vibration dampeners, will benefit from the use of 2-MT.

If you haven't already tried this outstanding accelerator, we strongly urge that you do so. Your request will bring a sample promptly. Complete information on Du Pont 2-MT may be found in Report No. 41-1. If you'd like another copy, call your Du Pont representative or write: E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Div., Wilmington 98, Delaware.

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DU PONT

150th Anniversary

BETTER THINGS FOR BETTER LIVING ... *THROUGH CHEMISTRY*

India Rubber World, October, 1952, Vol. 127, No. 1. Published Monthly by Bill Brothers Publishing Corp. Office of Publication, Orange, Conn., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U.S.A. Entered as Second Class Matter at the Post Office at Orange, Conn., under the act of March 3, 1879. Subscription United States and Mexico, $5.00 per year; Canada $6.00; All Other Countries $7.00; Single Copies 50 Cents. Address Mail to N. Y. Office.

Another new development using

B. F. Goodrich Chemical *raw materials*

Seal made by Roth Rubber Co., Chicago, for Vapor Heating Corp., Chicago. B. F. Goodrich Chemical Co. supplies the Hycar rubber only.

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—WITH HYCAR'S HELP!

THAT flexible, metallic conduit pictured has a rough, tough job—carrying steam heated to 400°F., under 250 pounds pressure, for heating railroad coaches.

Connected between cars, it has eight swivel joints to absorb jolts when the train rolls along. A seal at each joint must withstand the hot steam and vibration. And the seal manufacturer found that one made of Hycar, faced with asbestos, met all the severe requirements.

A natural choice, too, for Hycar has advantages that make it ideal for rugged service like this. Hycar rubber compounds can be made resistant to heat and cold, yet remain flexible and resilient under extreme temperatures. Hycar also resists water, weather, abrasion . . . gas, oil, many chemicals and more damaging factors.

Hycar may be the answer to your product development or improvement problems—the way to better, more saleable products. For helpful technical information on Hycar rubber compounds, please write Dept. HB-5, B. F. Goodrich Chemical Co., Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ont. Cable address: Goodchemco.

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● Keep that production line on schedule! Easy mixing, rapid incorporation, fast processing, swift tubing, quick cure! This quick-and-easy black produces rubber stocks of high-quality appearance, good plasticity and resiliency. Imparts high abrasion resistance, low cut and crack growth, reduced chipping.

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gives Maximum Protection for light-colored rubber!

This specially developed *new* **antioxidant gives rubber products** *excellent* **protection against heat, oxygen, and flexing fatigue—with a** *minimum* **of discoloration and staining.**

Now you can protect carcass stocks for white sidewall tires—without fear of staining by migration. Use Octamine in light-colored stocks for footwear, sponge, molded soles and heels, wire insulation, mechanical goods—wherever you need strong antioxidant protection without objectionable discoloration.

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Find out more about new Octamine and how it can help you to finer rubber products, more economically. **Send us the coupon below.**

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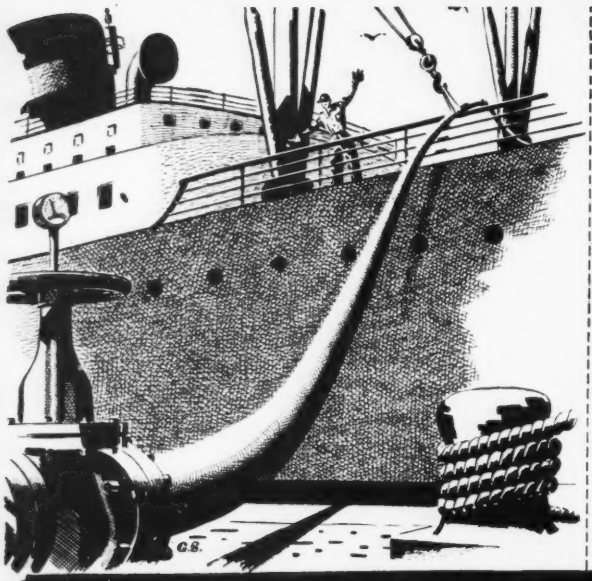
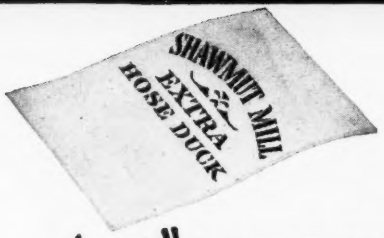


If it's got to lead a FLEXIBLE LIFE...



make it "SHAWMUT HOSE DUCK"

another Wellington Sears fabric for the rubber industry

A flexible life . . . and a long and satisfactory one! That's the basic result story of Shawmut Hose Duck, proven in a wide variety of rubber-and-fabric applications.

Especially suited for rubberized hoses for liquids and compressed air, this duck is a soft, open, plied-yarn cotton fabric affording flexibility and good impregnation. It is available in many standard, as well as non-standard, constructions to meet specific requirements.

Shawmut Hose Duck is but one of the many famous Wellington Sears cotton ducks for hoses, belting and other mechanical rubber products. Available from this "headquarters for industrial fabrics," for example, are Dredge Sleeve Duck for large suction hoses and Superior Army Duck widely used as a cover fabric for V-belts.

Based on its 100-year experience in heavy duty fabrics, Wellington Sears also offers fabrics incorporating the unique properties of nylon, high tenacity rayon and other fibers for steam hoses, bulk loading of chemicals and grains and other uses.

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An illustrated 24-page booklet filled with valuable facts on fabric development and applications of interest to present and potential users of industrial fabrics is yours for the asking. Write for a free copy of "Modern Textiles for Industry" to Wellington Sears Co., Dept. K-2, 65 Worth Street, New York 13.

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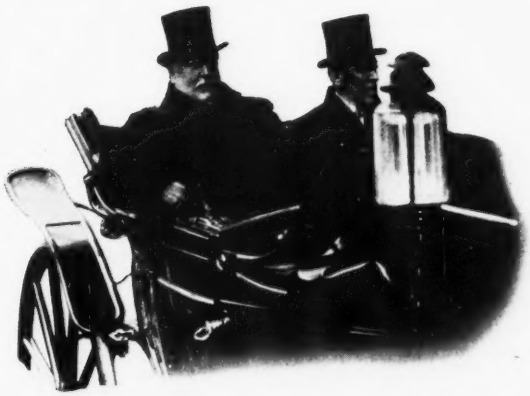

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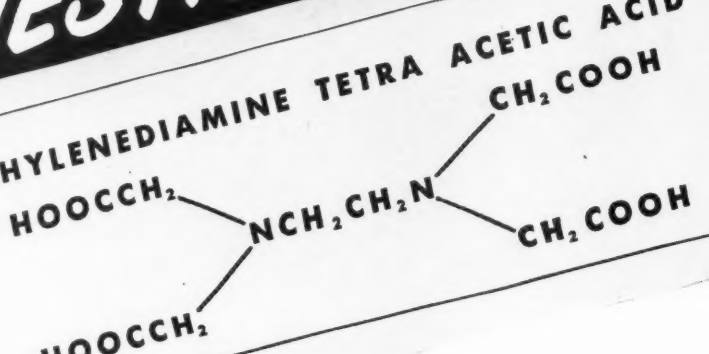

SEQUESTRENE is a non-colloidal organic chelating or complexing agent capable of deactivating heavy metal and alkaline earth ions. SEQUESTRENE will dissolve such sparingly soluble salts as calcium oxalate or magnesium stearate, will prevent precipitation of iron in alkaline solution, will deionize copper or manganese. SEQUESTRENE does not hydrolyze; it is stable over a wide range of temperature and pH; it is compatible with cationic materials and is soluble in many semi-aqueous and non-aqueous systems. TRY SEQUESTRENE wherever trace inorganic cations may be producing undesirable effects, as:

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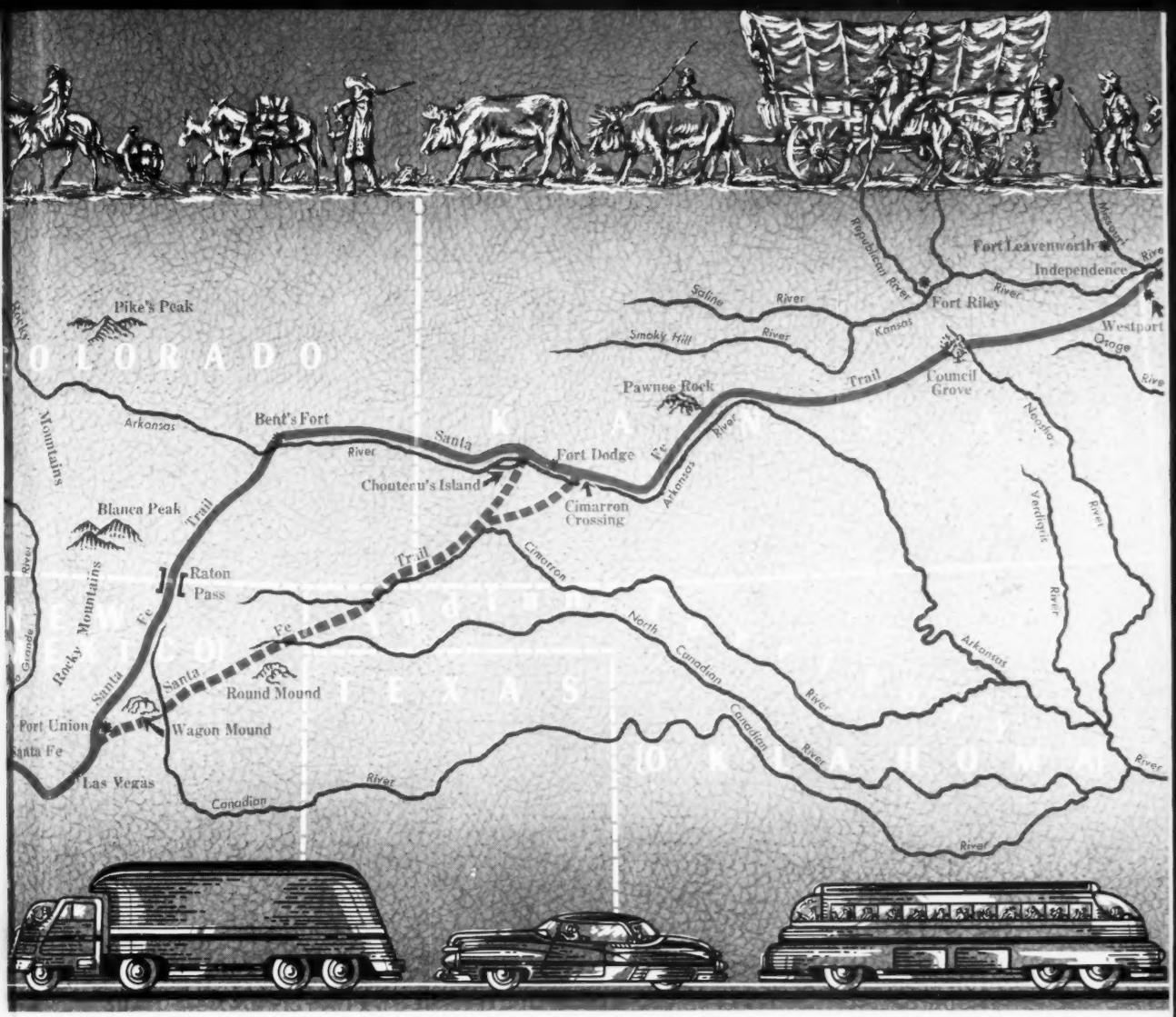

First in a series of Famous Trails, a Reminder of Man's Progress in Transporting Himself and His Products

THE SANTA FE TRAIL

In 1821 Captain William Becknell reached Santa Fe with the first wagons ever to make the journey from the States. The next year $15,000 in goods was transported across the prairies to the ancient town in the southwest. In 1826 Kit Carson ran away to join a caravan for Santa Fe.

Twenty years later the total value of goods making the journey amounted to $450,000. From Independence, Missouri, the Santa Fe Trail stretched out over nearly 800 arduous miles into unknown dangers and difficulties. Days piled upon days as the slow-moving wagons made their journey across the plains, into the shadows of the Rockies and at long last into the town of Santa Fe. The trail the wagons made became in time the thoroughfare for progress.

Today, on the Santa Fe Trail and all other roads where people may be reached, the rubber tire carries the commerce of the day. To the rubber tire we owe much of the tremendous progress man has made in transporting himself and his products.

. . . . . .

CARBON BLACK has played a vital role in this progress of transportation, because it is to carbon black that the rubber tire of today owes its strength, wearability, and mileage.

Not far from Santa Fe, at Eunice, New Mexico, is one of our several plants where we manufacture, from natural gas, this product which contributes so much to better transportation on today's Santa Fe Trail.

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United Carbon blacks have the top quality mandatory for tires and other rubber products to blaze a trail in leadership and unexcelled performance. United Carbon blacks are expertly made and scientifically controlled for consistent uniformity and highest standards. Stay ahead with United blacks.

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★ BETTER PROCESSING
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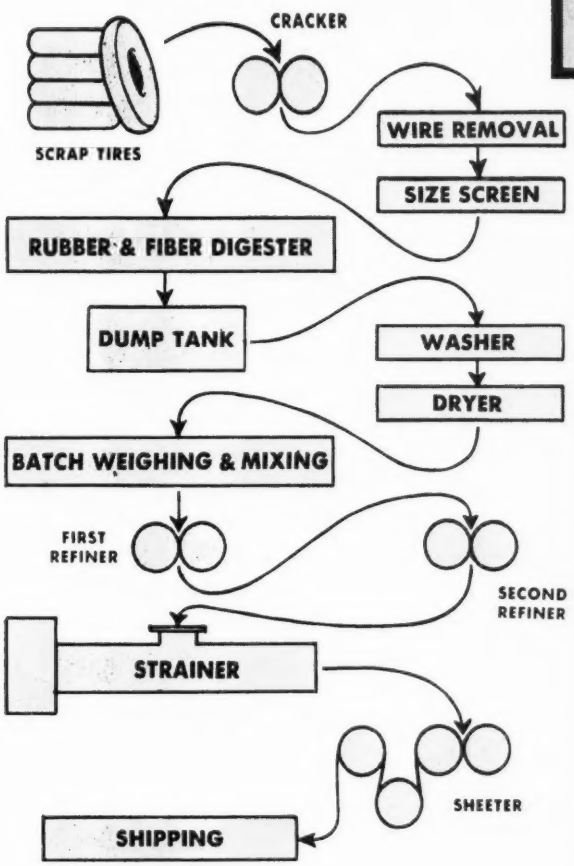
24 HOURS



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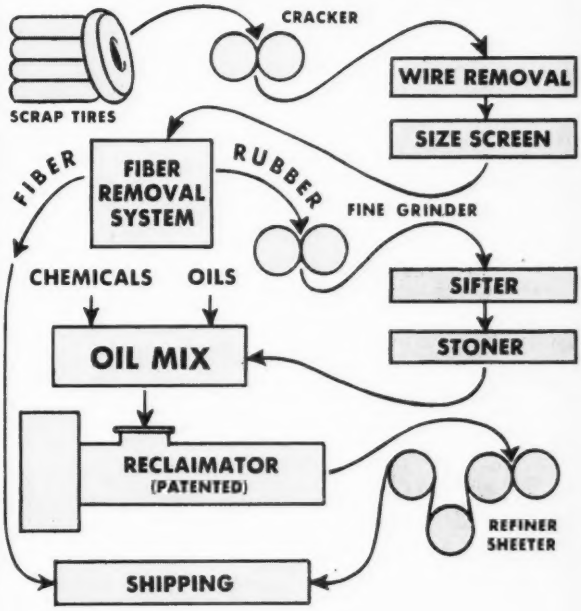

The two flow-charts above will readily demonstrate why our new exclusive and patented DIP-PROCESS of rubber reclaiming delivers greater quality to every user. Because of the *extremely short cycle* in which the compound is in process, MORE of the *original quality* of the rubber is retained. This in turn imparts greater resistance to (1) abrasive wear (2) heat and (3) ozone and better aging of your finished products.

Dip-Process Reclaims are also more uniform, less scorchy and have the correct tackiness. In addition, they permit larger Banbury loadings and faster mixing.

And, here's how Dip-Process Reclaims can substantially lower your costs! Now, you can use higher loadings of reinforcing fillers and softeners (such as MR and unsaturated petroleum products) with no deterioration of physical properties. Write us now for ALL the details!

69 years serving the industry solely as reclaimers

U.S. RUBBER RECLAIMING COMPANY, INC.

The Industry's talking . . . about POLYMEL D

solid, friable, styrene-indene copolymer resin

From all over the nation customers report superior performance and processing advantages when they use POLYMEL D. Here's what they say:

about MIXING and PROCESSING — "Polymel D is the finest dispersing agent for highly loaded Silene stocks that we have ever used."

about MILLING — "Polymel D reduces milling time and acts as a wetting agent and dispersion agent for reinforcing fillers. With correct die heat and pressure Polymel D will get high speed and fine surface finish!"

about MOLDING — "Polymel D serves very much like a tough, compatible molding wax, but without the objectionable characteristics of a wax. It provides good register and reduces defectives. When cracks and imperfections are likely to show up in the cured article, Polymel D makes the stock flow better and mold more perfectly!"

about CALENDERING — "Polymel D imparts just enough softness to give good calendered gauge control. It acts as a softener that does not reduce the hardness of cured compounds with normal milling . . . an outstanding processing agent for highly loaded Silene and Hi-Sil compounds."

about DOSAGE — "We recommend 5 to 15 parts on the rubber hydrocarbon." "Where there would be natural rubber, GR-S, Neoprene or Buna-N, we recommend from 5 to 7½ parts on the hydrocarbon."

about GENERAL CHARACTERISTICS — "We have found Polymel D, when used with high styrene copolymers, gives good processing properties without interfering with the cured functions of these materials."

"This material gives excellent reduction in shrinkage and splendid extrusion characteristics."

"It lends no stickiness to a rubber compound but seems to occasion an easy release from the rolls."

ALSO ASK ABOUT THESE QUALITY POLYMEL PRODUCTS

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(solid)—Extender, Wire Compounds

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POLYMEL 6
(solid)—Tires, Camelback

POLYMEL 7
(liquid)—Tires, Camelback, Carcass

SUBLAC PX-5
(powdered)—Resin

POLYMEL C-130
(solid)—Plasticizer

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(solid)—Non-coloring Detackifier

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Write today for FREE technical bulletin and laboratory samples. *They're yours on request.*

PRICE on production quantities:

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Thermometers

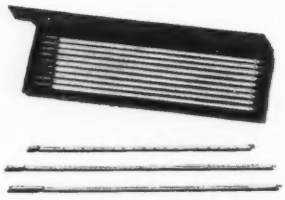
in all forms—ranges—stem lengths—connections

Whether your requirement calls for certified laboratory thermometers . . . or rugged all-metal industrial types . . . or thermometers for remote reading . . . you'll find *exactly* what you require in the Weston-TAG line—*the most comprehensive line of quality thermometers ever offered by ONE manufacturer.* Literature on request. WESTON Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, New Jersey.

Laboratory

ALL-METAL

—have readable, dial-type scales and corrosion-resisting stainless steel stems—stem lengths from 2" to 24"—ranges from low as −100°F. to high as 1000°F.—accuracy ½ of 1% of thermometer range.



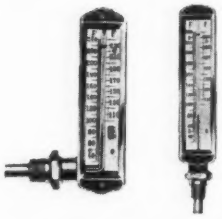
GLASS

—certified sets of ASTM Testing thermometers with overlapping ranges in protective case. Ranges from −36°F. to high as 760°F. Also precision and standard etched stem thermometers for general testing.

Industrial

ALL-METAL

—provide unmatched readability and durability—accuracy within 1% of thermometer range. Available in all types, ranges and stem lengths (2½" to 72") for all requirements.



GLASS (Metal Case)

—available in all forms, all ranges, stem lengths and connections. Accuracy within one scale division. Also submarine types, metal and cupcase thermometers.

Remote Reading

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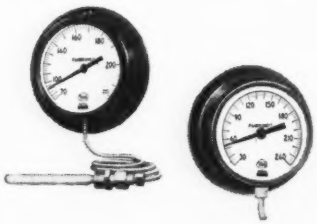
—resistor bulb sensing element permits mounting indicator any distance away from point of measurement. *Multiple* remote readings also possible by use of selector switch and several bulbs.



PRESSURE ACTUATED

—for remote reading, in 5, 6 and 8" dial sizes. Ranges from low as −325°F. to high as 1000°F. Accuracy one scale division unaffected by vibration or severe shock. Cases of iron, brass, or plastic.

WESTON *Temperature Instruments*

— TO INDICATE — RECORD — CONTROL

9413

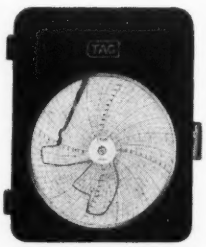
"TAG" Automatic Controllers Record Temperature, Pressure

Pressure, vacuum or temperature can be automatically regulated and recorded with the Pneumatic Recorder-Controllers produced by TAGliabue Instruments Div., Dept. 67, Weston Electrical Instrument Corp., Newark 5, N. J. These devices maintain conditions for which they are set by varying control line air pressure, which operates a diaphragm valve to regulate flow of fluid (gas, steam, liquid) to the equipment being controlled. At the same time, the instrument continuously records actual temperature or pressure on a circular chart.

Operating on an air supply of 18 p.s.i., TAG Recorder-Controllers handle temperatures between −100°F. and 1000°F., vacuum as great as 30" mercury, or pressures up to 7500 p.s.i.

"TAG" Temperature Recorders Chart from −300° to +1000°F.

Accurate written records of varying temperatures are charted by the Temperature Recorders produced by TAGliabue Instruments Div., Dept. 67, Weston Electrical Instrument Corp., Newark 5, N. J. Temperatures as low as −300°F. or as high as +1000°F. can be recorded with these versatile instruments.



Various types of actuations in TAG Temperature Recorders achieve scale expansion for utmost precision over the working ranges. Interchangeable tube systems are laboratory calibrated at the factory. A safety link provides over-range protection. Details are given in Catalog 1210.

"TAG" Pneumatic Controllers Govern Temperature, Pressure

Pressure, vacuum or temperature can be accurately regulated by the Pneumatic Controllers engineered by TAGliabue Instruments Div., Dept. 67, Weston Electrical Instrument Corp., Newark 5, N. J. These trustworthy devices maintain the conditions for which they are set by varying air pressure in a control line, which in turn operates a diaphragm valve to increase or decrease the flow of fluid (air, gas, steam, liquid) to the equipment being controlled.

Operating on an air supply of 18 p.s.i. pressure, TAG controllers handle temperatures between −100°F. and 1000°F., or pressures between 30" vacuum and 7500 p.s.i.

This conveyor handles oil-treated fuel—and lasts longer because it's made with CHEMIGUM

THIS conveyor belt has built-in resistance to oil – because it's made with CHEMIGUM—Goodyear's nitrile-type synthetic rubber. Laboratory tests show that CHEMIGUM in belt-cover stock swells only 2% as much as high-grade conveyor covers made from natural rubber – maintains tolerances to reduce unnecessary wear.

Easiest processing of all nitrile rubbers, CHEMIGUM may solve your problems wherever severe oil and grease conditions cause premature failure of conventional materials. Write for further details to:

Goodyear, Chemical Division
Akron 16, Ohio

Chemigum, Pliobond, Pliolite, Pliovic–T.M 's The Goodyear Tire & Rubber Company, Akron, Ohio

This conveyor belt – designed to handle oil-treated fuels – is built with special CHEMIGUM *cover and* CHEMIGUM *Friction Compounds to insure maximum oil resistance and longer service.*

CHEMICAL
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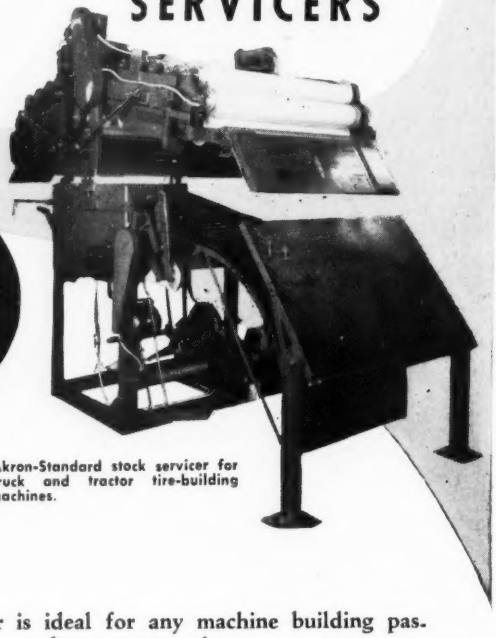
Help Your Tire Builders

Speed Up with

AKRON-STANDARD STOCK SERVICERS

Akron-Standard stock servicers are made in many sizes. Both sets of stock rolls are connected together by chain drive to sprockets from motors mounted on side of frame.

FOR USE WITH ANY SINGLE OR DUAL BEAD TIRE-BUILDING MACHINE



Akron-Standard stock servicer for truck and tractor tire-building machines.

Another Akron-Standard aid to modern, streamlined production — a stock servicer which supplies material to the tire builder without leaving his position (ideal for women operators). It handles plies, chafers, tread and breaker. No placing of fabric in loose liners — no more unnecessary handling anywhere! Uniform tension makes for a uniform product. The tire builder controls each roll with an index button which operates the motor drive. A limit switch automatically stops the roll. The stock rolls are filled so that each ply comes in proper sequence with the cord angles reversed correctly as applied to the drum. The Akron-Standard stock servicer is ideal for any machine building passenger, truck or tractor tires.

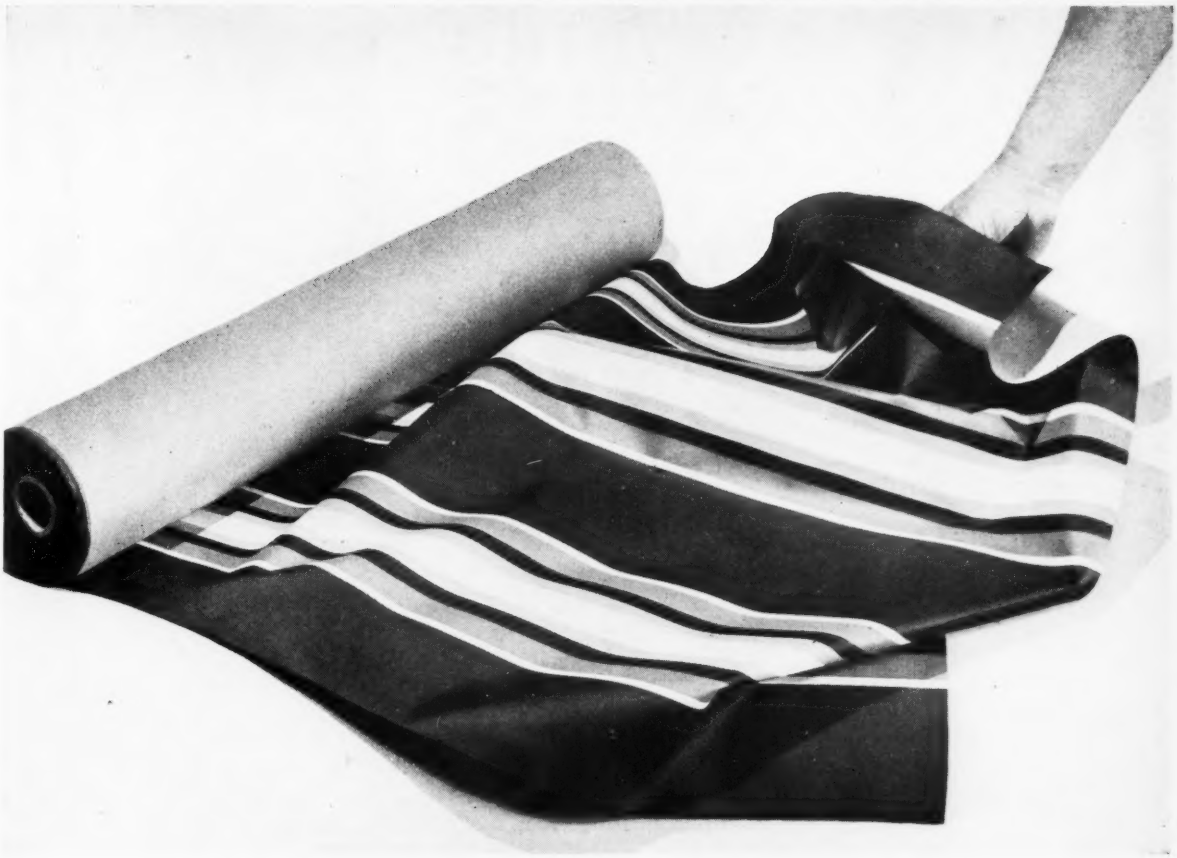
Details. On one side of the upper unit are 12 rolls, six of which carry the self-winding liner and six the stock fabric for the operator. The stock is fed to the rolls at the back. When filled, the turret is turned for the next tire.

Ask for our 40-page Bulletin "W-10", describing this and many other profit-earning types of Akron-Standard equipment.

The Akron Standard Mold Co.

1624 Englewood Avenue — *"The Established Measure of Value"* — Akron 5, Ohio, U. S. A.

Soft hand and casual drape characterize this PLIOVIC *coated fabric manufactured by the Graniteville Manufacturing Company, Graniteville, S. C.*



BETTER TEXTILE COATINGS—

when your vinyl dispersions are made with PLIOVIC

TEXTILE manufacturers everywhere are relying on PLIOVIC – Goodyear's vinyl for use either in organosol, plastisol or latex dispersions. Such coatings when used on textile materials have these outstanding advantages:

1. Lower fusing temperatures 2. Less discoloration 3. Higher gloss 4. Greater clarity 5. Lower water sensitivity

PLIOVIC gives you production advantages, too. Fusing temperatures are from 25°-50° lower—protection against scorch and damage to base fabrics. You need less costly plasticizer with PLIOVIC—and can disperse the resin in less time using standard equipment.

If you have a textile coating problem—or want assistance in developing new finishes and products, it will pay you to investigate PLIOVIC. Ask a Goodyear Chemical Division representative for details, or write:

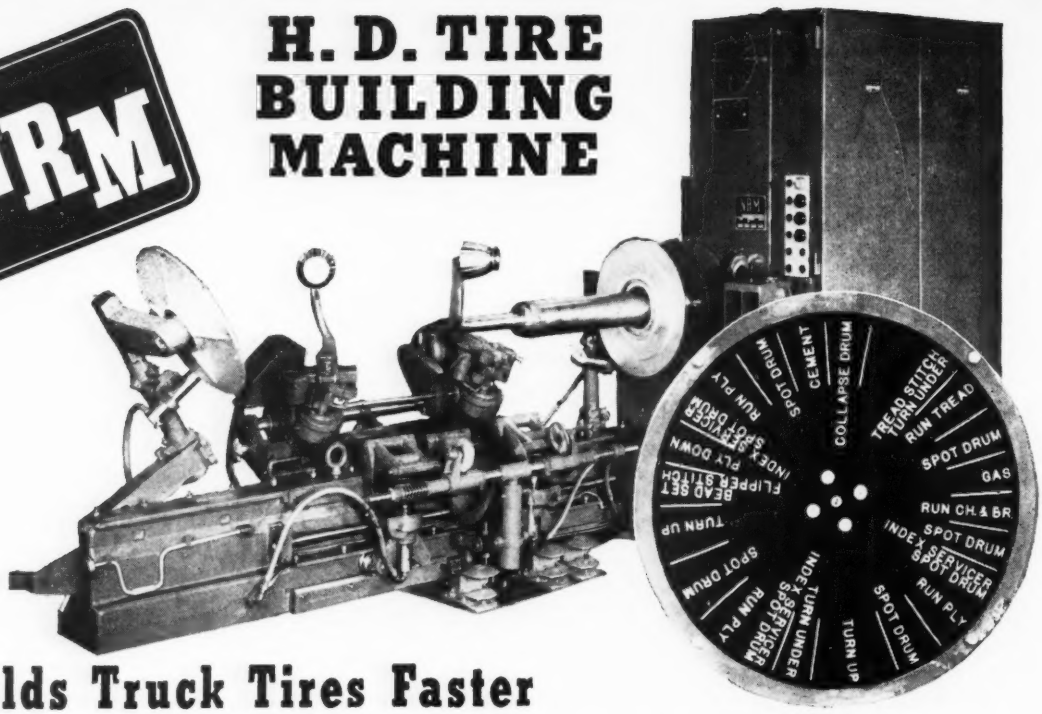
Goodyear, Chemical Division, Akron 16, Ohio

CHEMICAL GOODYEAR DIVISION

Chemigum, Pliobond, Pliolite, Pliovic–T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Use Proved Products — CHEMIGUM • PLIOBOND • PLIOLITE • PLIOVIC • WING-CHEMICALS — The Finest Chemicals for Industry

H. D. TIRE BUILDING MACHINE



Builds Truck Tires Faster

NRM's new Model 53 H.D. Truck Tire Building Machine. Inset shows dial on electronic timer.

Newest addition to NRM's line of proved and popular tire building equipment is its Model 53 Heavy Duty Truck Tire Building Machine.

A companion machine to the Model 52 for passenger size tires, the Model 53 permits truck tire builders to produce their tires on a semi-automatic basis—at greater speeds—with more uniformity — and, at new saving in production costs.

Improved production with the Model 53 is realized through complete tooling and the replacement of the manual functions of "brake over," "turn up," and "tuck under." This rugged, yet precision-built machine helps the operator build a better tire faster.

Look over these construction details. See how these newest NRM machines compare with your present equipment. Then, write for more information.

	MODEL 52	MODEL 53
BEAD CONSTRUCTION	SINGLE	SINGLE
Drum Size	Primarily for 14" to 16" Bead Size	Primarily for 20" to 24" Bead Size
Bead Diameter Range	12" to 20"	14" to 24"
Shoulder Set	10" to 21"	14¼" to 26" (11½" to 14¼" with Special Attachments)
Maximum Drum Diameter	22"	26"
Control	Manual—Semi-Automatic and Automatic	Manual—Semi-Automatic
Timer	Electronic Sequence Timer with Program Drum	Electronic Control for Sequence of Operations
Drum Speeds	190 RPM Bead Stitch 96 RPM Bead and Tread Stitch Low Speed Thru Torque Control for Stock Application	245 RPM Bead Stitch 147 RPM Bead and Tread Stitch 50 RPM Stock Application
Maximum Green Tire O.D.	24"	29"
Tread Stitcher Speed	52" per minute	52" per minute 26" per minute (2 Speed Motor)
Maximum Ply Width	30"	42"
Tire Size	4.50 to 8.00 inc. Cross Sections	5.00 to 10.00 inc. Cross Sections
Weight, Net	3800 lbs.	6100 lbs.
Floor Space	4'6" wide x 9'10" long x 6'0" high.	5'6" wide x 12'10" long x 6'4" high.

2079

NATIONAL RUBBER MACHINERY COMPANY

NRM

General Offices & Engineering Laboratories: Akron 8, Ohio

East: 384 Getty Ave., Clifton, N. J.

West: S. M. Kipp, Box 441, Pasadena 18, Cal.

Export: Omni Products Corporation, 460 Fourth Ave., New York 16, N. Y.

Creative Engineering

No water extraction
Best color retention
Positive antioxidant protection

with *Wing-Stay S*

IN FISHING lures, bathing caps, surgeons' gloves—wherever light-colored or white rubber products are washed, sterilized or just immersed in water – it pays to use WING-STAY S for antioxidant protection. For under ordinary conditions, this antioxidant is *never* removed by water. This assurance of lasting protection is coupled with the best color retention – all at surprisingly low cost.

If you are now using any of these GR-S rubbers—1006, 1012, 1502 or X693 – you already have these advantages of WING-STAY S working for you. For since August 1951, more nonstaining GR-S has been made with WING-STAY S than with all other antioxidants combined.

You can safely turn to this use-proved antioxidant, thanks to large production facilities that assure you of a dependable supply. Write for further details to:

Goodyear, Chemical Division, Akron 16, Ohio

CHEMICAL
GOODYEAR
DIVISION

Chemigum, Pliobond, Pliolite, Pliovic, Wing-Stay–
T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Use Proved Products — CHEMIGUM • PLIOBOND • PLIOLITE • PLIOVIC • WING-CHEMICALS — The Finest Chemicals for Industry

HOW TO- SAVE PRODUCTION DOLLARS with PROTOX* ZINC OXIDES...

The patented coating of zinc propionate on Protox oxides provides outstanding advantages that cut your production costs these 5 ways:

SAVE STORAGE COSTS

You save 33% of space with Protox; it has lower bulking.

SAVE HANDLING COSTS

You can buy Protox in unit-load cars. You save inter-plant hauls by loading more Protox per truck.

SAVE PRODUCTION COSTS IN HUMID WEATHER

You process Protox faster; it has less moisture pickup.

SAVE ZINC MASTERBATCHING COSTS

You cut out this step with Protox; it has excellent dispersion.

SAVE BANBURY COSTS

You mix Protox faster; rubber wets it quicker.
You mix larger batches; Protox bulks 33% less.

How much can ***you save*** with Protox zinc oxides?
The best way to find out is to order a plant batch today.

*U. S. Patents 2,303,329 and 2,303,330.

THE NEW JERSEY ZINC COMPANY

Producers of Horse Head Zinc Pigments

... most used by rubber manufacturers since 1852

160 Front Street, New York 38, N. Y.

FORD MOTOR COMPANY OFFICIALS INSPECT THE INTERCHANGEABLE UNITS OF THE . . .

New G-E Motor Control Center

Since January, over 10,000 men from production and management of leading industries (see above) have taken a thorough look at the latest equipment for the centralized control of a-c motors up to 200 hp. Their reports indicate enthusiastic approval of what they saw. Here's why:

VERSATILE. Because units are easily interchangeable without waste space, a variety of arrangements can be made. For example—two Size 1 or 2 starter units require the same space as a Size 1, 2, or 3 reversing starter.

ACCESSIBLE. A four-inch continuous wiring trough provides ample wiring space. Components are mounted on an easy-to-handle frame and accessible from all sides when lifted from cabinet. Starters are front-connected. Master terminal boards can be swung out of compartment for extra working space around conduit.

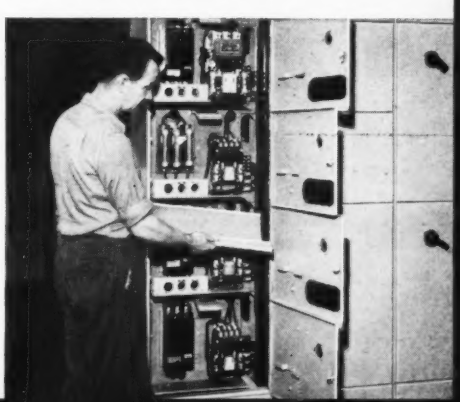
PROTECTED. Will withstand 25,000 amperes RMS short-circuit current, substantiated by certified Laboratory tests.

For more information on this new G-E motor control center, contact your nearest G-E apparatus sales office or write for Bulletin GEA-4979A today. *General Electric Company, Schenectady 5, N. Y.* 730-42

EASY TO INSTALL AND INSPECT. Interchangeable units; main bus completely accessible; incoming line connections are easily made.

EASY TO WIRE. Four-inch wiring trough; components accessible from all sides; front-connected starters; doors swing more than 90°.

EASY TO SERVICE. Units are easily disconnected from bus and locked in test position (above). Barriers between units are easily removed to facilitate wiring (below).



GENERAL ELECTRIC

For natural rubber compounds

For light or dark rubber—if you want soft, flexible natural compounds with maximum tear resistance—call for Multifex® MM. It gives you all these qualities at low cost; loadings can reach ratios of 100 parts Multifex MM to 100 parts natural rubber. Multifex MM disperses easily, too, especially when mixed as a concentrated master batch, then cut back to desired loading.

Write for our technical bulletin, "Precipitated Calcium Carbonates in Rubber and Polyvinyl Compounds".

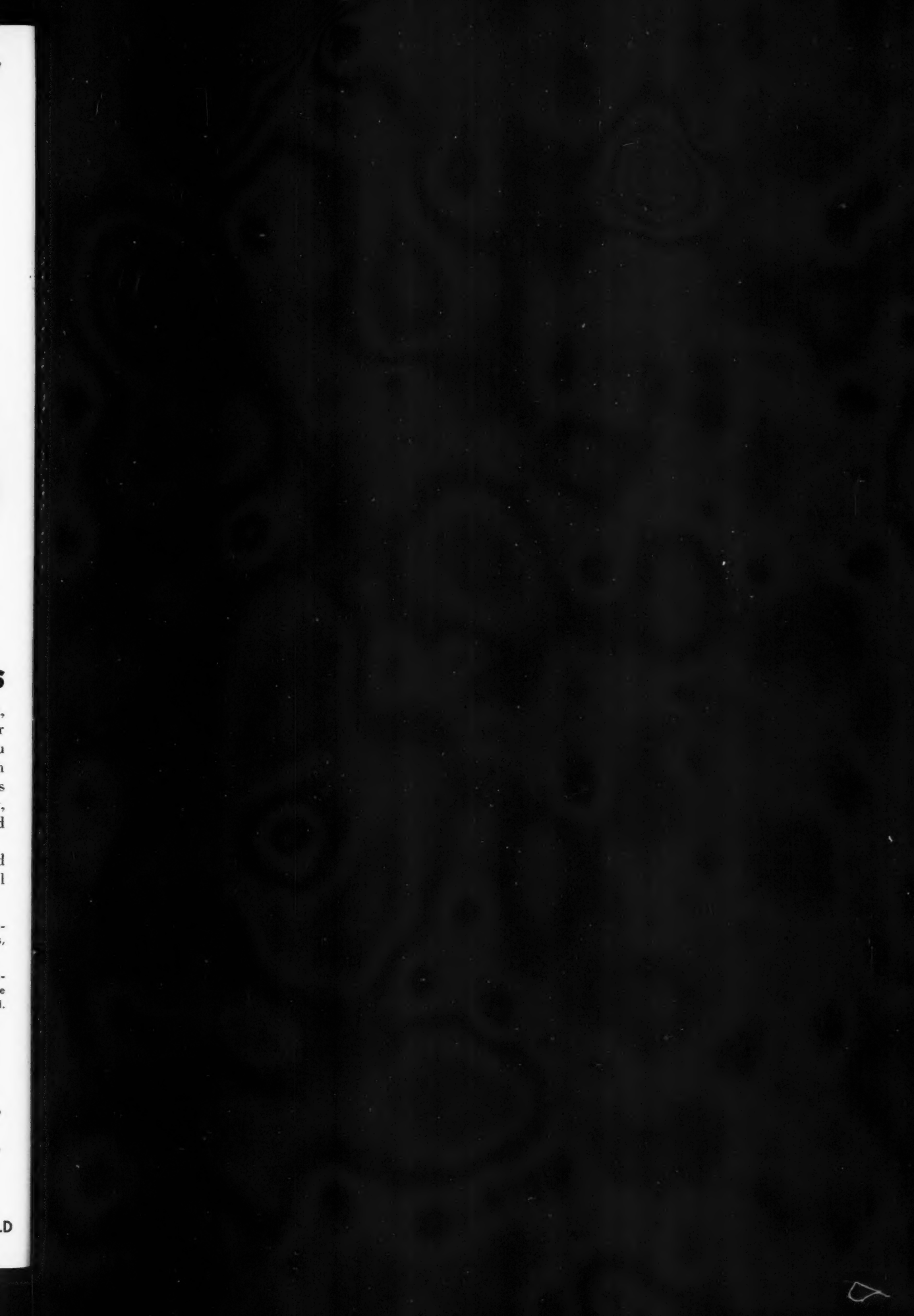
DIAMOND SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Houston.

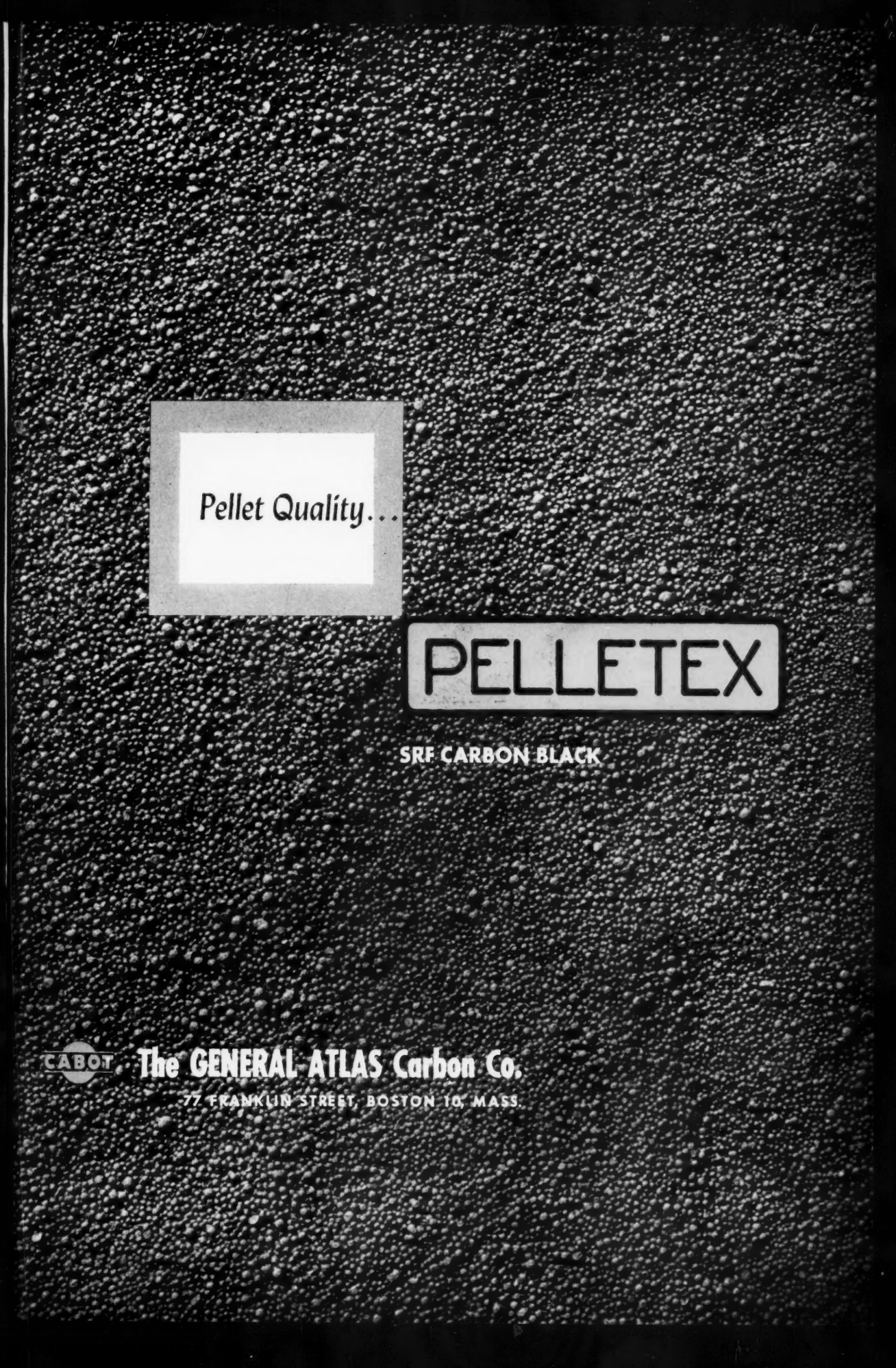
DIAMOND DISTRIBUTORS: C. L. Duncan Co., San Francisco and Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U. S. A.; Harrisons & Crosfield (Canada) Ltd.

DIAMOND CHEMICALS FOR THE RUBBER INDUSTRY

DIAMOND ALKALI COMPANY...CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS®




Pellet Quality...
PELLETEX
SRF CARBON BLACK
CABOT
The GENERAL ATLAS Carbon Co.
77 FRANKLIN STREET, BOSTON 10, MASS.

Thiokol* PLASTICIZER TP-90B

obtains maximum low temperature flexibility in NATURAL and SYNTHETIC RUBBERS

It has been proven that Thiokol TP-90B is highly compatible with natural rubber, GR-M, Buna N's and GR-S synthetic rubbers.

TP-90B imparts excellent low temperature flexibility to these elastomers and maintains high resilience over a wide temperature range.

The following formulated compounds illustrate the flexibility obtainable through the use of Thiokol Plasticizer TP-90B.

	Natural Rubber	GR-M (Neoprene)	Hycar OR-15	Paracril-B	GR-S
Smoked Sheets	100.00				
GR-M		100.00			
Hycar OR-15			100.00		
Paracril-B				100.00	
GR-S					100.00
Zinc Oxide	5.00	5.00	5.00	5.00	5.00
E.L.C. MgO	—	4.00	—	—	—
S.R.F. Black	50.00	—	100.00	100.00	60.00
E.P.C. Black	—	50.00	—	—	—
Stearic Acid	1.50	1.00	1.00	1.00	0.50
BTDS (a)	1.00	—	1.50	1.50	1.25
TMTDS (b)	.10	—	—	—	.20
Sulfur	3.00	—	1.50	1.50	1.75
TP-90B	30.00	20.00	30.00	30.00	30.00
Cure	30/310°F	45/300°F	30/310°F	30/310°F	30/310°F
Tensile	2200	2600	2380	2250	1500
Elongation	530	410	300	350	380
Durometer	42	68	70	61	45
**Low Temperature Flexibility	−95°F	−70°F	−70°F	−80°F	−95°F

(a) Benzothiazyl disulfide
(b) Tetramethyl thiuram disulfide

**Low temperature flexibility was measured using a modified torsional tester devised by U. S. Rubber Company. The temperatures shown are the values at which the absolute moduli is 10,000 pounds per square inch. G 10,000 value is taken as the stiffening point although the specimens were still quite flexible.

This information is believed to be accurate. However, no warranty is expressed or implied regarding the accuracy of these data, or the use of this product.

For technical information write:

Thiokol* CORPORATION

*Thiokol, Reg. U.S. Pat. Off.

784 North Clinton Avenue, TRENTON 7, NEW JERSEY

COLUMBIA-SOUTHERN

calcene nc

FOR SUPERIOR WHITENESS AND ECONOMY

Calcene NC is a new development by Columbia-Southern to meet a need in the rubber industry for a white reinforcing calcium carbonate pigment at a moderate price.

Hunter Reflectometer tests show Calcene NC to be of excellent white color as compared with similar pigments, and of special value as a reinforcement for white or light pastel molded goods and sundries.

Thorough testing of competitive materials clearly indicates Calcene NC as the most economical of the fine-particle calcium carbonates at equivalent property levels.

In a straight mill mix, Calcene NC disperses easily and will show no variation where masterbatching techniques are used. In some cases, it may be possible by switching to Calcene NC to eliminate the masterbatching step and still obtain a high level of properties.

Columbia-Southern will be glad to supply samples of Calcene NC for your experimental purposes. Also, you are invited to make use of the services of Columbia-Southern's technical staff to help you with any of your problems involving Calcene NC, Calcene TM, Silene EF and Hi-Sil. Write, wire, or telephone us at the address below.

CALCENE NC is a non-coated, fine-particle, precipitated calcium carbonate. It is similar to Calcene TM in both physical and chemical properties except that it is non-coated.

COLUMBIA-SOUTHERN
CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY

EXECUTIVE OFFICES: FIFTH AVENUE AT BELLEFIELD, PITTSBURGH 13, PA. • *DISTRICT OFFICES:* BOSTON • CHARLOTTE • CHICAGO • CINCINNATI CLEVELAND • DALLAS • HOUSTON • MINNEAPOLIS • NEW ORLEANS • NEW YORK • PHILADELPHIA • PITTSBURGH • ST. LOUIS • SAN FRANCISCO

MOLDS COME CLEAN *Everytime* WITH COLITE!

Just as a housewife butters a muffin tin, you can use Colite on any kind of a rubber mold. And you'll find using this highly-concentrated liquid mold-release, as a spray or sponge, pays off with substantial savings!

You can count on jobs coming out with uniform precision — with no pinching, dragging, trimming or spoilage to contend with — and with a transparent, smooth, satiny finish that insures added sales-appeal.

Non-toxic, non-tacky, odorless Colite, developed especially for the rubber industry, comes in a highly-concentrated form, which you dilute with water to the most effective strength for the stock and job at hand — making it economical to use! Send for a sample to test in your plant, now!

Use as a spray or sponge on

Tire molds
General molds
Recapping molds
Inner-tube molds

★

Use as a lubricant for

Tires or Mandrels

★

For light colored stock

SPECIFY COLITE D43D

BEACON
PURITY · UNIFORMITY · DEPENDABILITY
Chemical Industries, Inc.
BOSTON (Cambridge) MASS.

Are you the Master

of your Paracril® product performance?

Whatever your Paracril product, whether hose or O-rings, diaphragms or printing rolls, *the proper use of plasticizers* will make you the master of your product's properties and performance.

Depending upon the type, combination, and concentration of plasticizers or softeners used, you can increase low temperature flexibility, aid processing, improve tensile strength and tear resistance—bring out exactly those properties *you* want.

Organic ester-type plasticizers, for example, contribute toward low temperature flexibility and high resilience. Coal tar derivatives improve tack, tensile strength, and tear resistance, while petroleum products are particularly useful where high elongation and good tear-resistant compounds are required.

An extensive study has been conducted for your benefit on the use of plasticizers in the Paracrils. To make sure you're getting all the benefits Paracril offers, send for our interesting Technical Bulletin No. 4. Simply fill out the coupon below.

Naugatuck Chemical, 1310 Elm Street
Naugatuck, Connecticut

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NAUGATUCK Chemical

DIVISION OF UNITED STATES RUBBER COMPANY

NAUGATUCK, CONNECTICUT

IN CANADA: NAUGATUCK CHEMICALS DIVISION • Dominion Rubber Co., Ltd., Elmira, Ont.

Rubber Chemicals • Aromatics • Synthetic Rubber • Plastics
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SEE WHAT IS AVAILABLE AT

Farrel-Birmingham has earned the right to the title of "Calender Headquarters" because it has—

BUILT MORE CALENDERS for processing rubber, plastics, linoleum, asphalt tile and other materials than all other manufacturers combined. In the last few years, the company has made over 100 plastics calenders alone.

BUILT MORE DIFFERENT TYPES OF CALENDERS, including every one represented by the thirty-four diagrams shown on the opposite page.

PIONEERED MORE IMPROVEMENTS IN DESIGN. For example, the Z-type calender which has been specially developed for high-speed production of plastic film and fabric coating. One manufacturer, using a Z-type calender, is able to produce, for the first time on a commercial scale, 1.7 gauge, calendered, unsupported vinyl film. The variation in accuracy of gauge of the final product is less than plus or minus .0001 inch. Other records, equally impressive, have been established by Farrel-Birmingham calenders in other fields.

BEFORE YOU DECIDE ON A CALENDER, call in a Farrel-Birmingham engineer. With the experience of "Calender Headquarters" behind him, he will be able to help you find a solution to your calendering problems. In the meantime, send for a copy of Bulletin No. 174 which describes these calenders in detail.

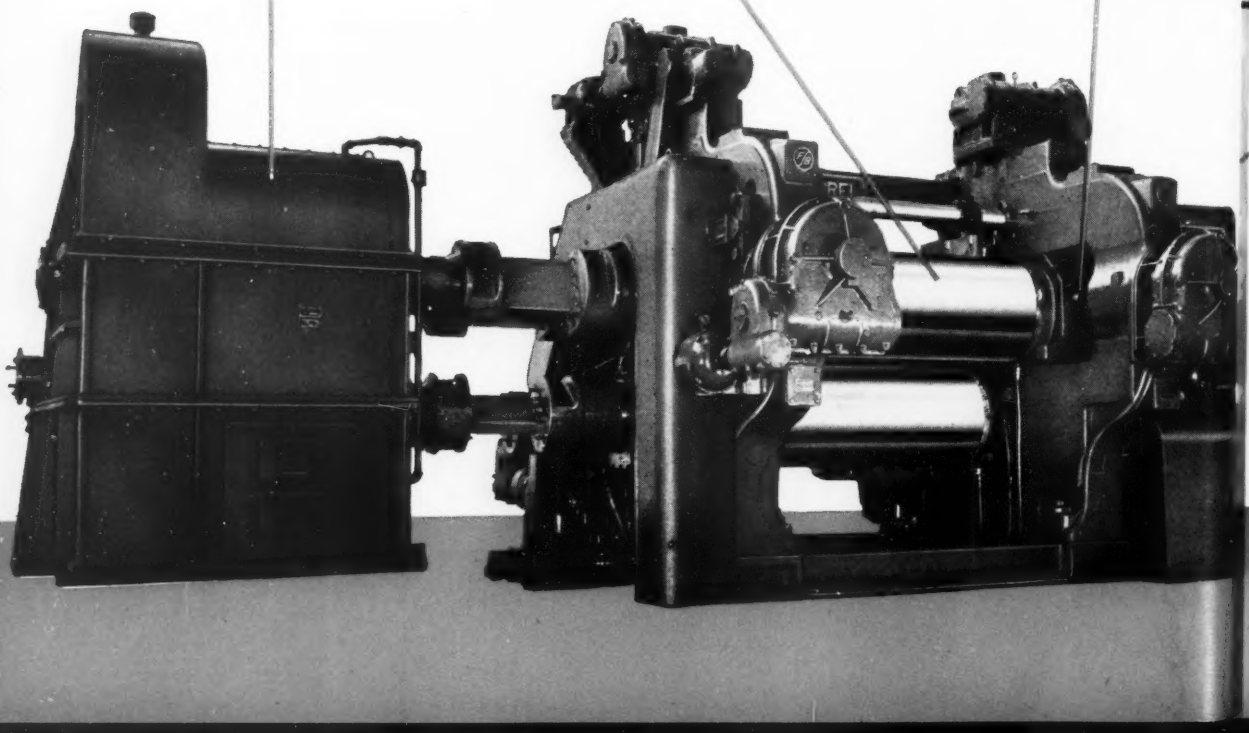
FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

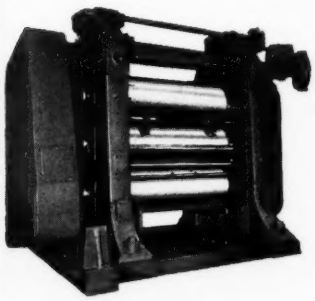
GEARING enclosed in separate uni-drive and connected to the rolls by universal spindles. Assures smooth and efficient transmission of power at high speeds and under heavy torque loads.

Z-TYPE FORMATION OF ROLLS eliminates the effect on roll settings of pressure from a third roll. A built-in device provides means for crossing the roll axes to compensate for deflection.

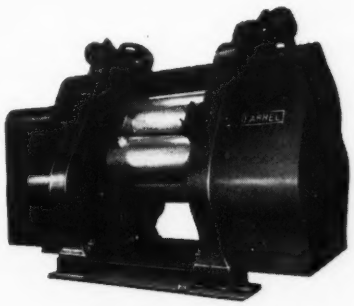
PRECISION BEARINGS wi hydraulic pullbacks for holding rolls in positive operating position. Labyrinth oil seals positively retain oil in boxes and prevent contamination of stock.



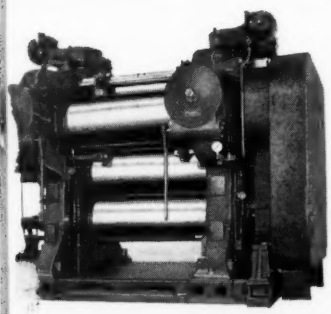
"CALENDER HEADQUARTERS"



24"x68" three-roll rubber calender equipped with spreader roll, tension roll, knife bar, weighted pressure roll and guides. Windup and letoff are on the other side.



24"x56" special, three-roll, triangular calender for sheeting and coating. Arrangement of rolls facilitates feeding and provides closer control of gauge.

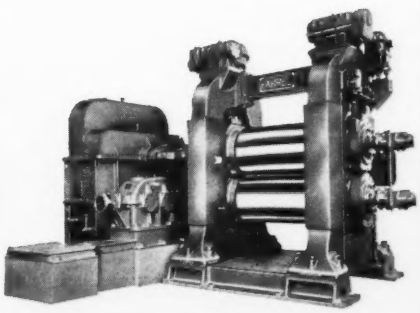


'x66" four-roll inverted L-type plastics lender with individual motor adjustent on each screw of top and bottom olls and hand ratchet adjustment for he side roll.

This giant 48"x84" two-roll inclined linoleum calender is the largest in the industry. Because of the great weight of the rolls, a roller table mounted on antifriction bearings is provided for roll removal.

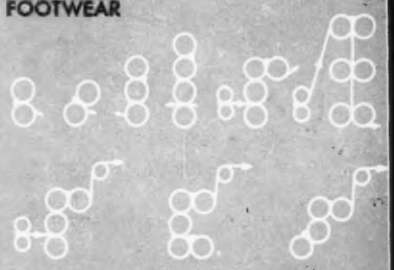
ROLL ADJUSTMENT by individual motor for each screw permits extremely fine adjustment. Pushbutton control provides for adjustment of either roll end separately or both together.

32"x92" four-roll, Z-type calender, specially developed for high-speed, high-precision production of plastic film and for fabric coating.

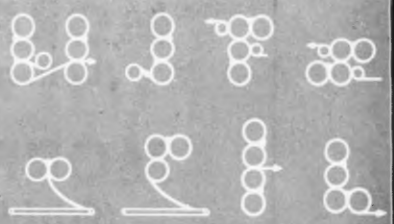


30"x54" two-roll asphalt tile calender proportioned for great strength and resistance to deflection. Gearing is enclosed in a separate uni-drive.

FOOTWEAR



TIRES



MECHANICAL GOODS

RUBBER THREAD AND GUM SHEET

RUBBER SUNDRIES

PLASTICS FILM

FLOORING

Farrel-Birmingham®

3 NEW PLASTICIZERS

for Vinyl and other Synthetic Resins

MORFLEX 130*
(Di-Decyl Phthalate)

MORFLEX 175*
(Octyl-Decyl Phthalate)

Two new plasticizers of extremely low volatility—good compatability and efficiency — imparting excellent dimensional stability in films — low water and oil extractability — excellent resistance to heat aging and the same high electrical characteristics as found in Morflex 100.

Ask your Burgess Representative or write for sample and technical data.

MORFLEX 330*
(Di-Decyl Adipate)

A low cost, low temperature plasticizer with good efficiency, low volatility and excellent resistance to heat aging. An excellent low cost replacement for products such as Di-Octyl Sebacate.

***(Manufactured by Morton-Withers Chemical Co.)**

Burgess Pigment COMPANY

EXECUTIVE SALES OFFICES: 64 HAMILTON ST., PATERSON 1, N. J.
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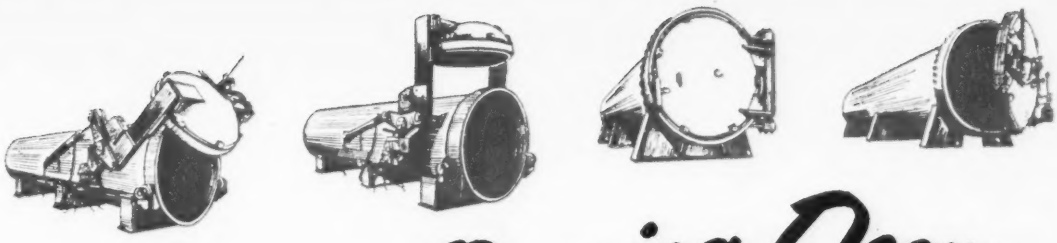
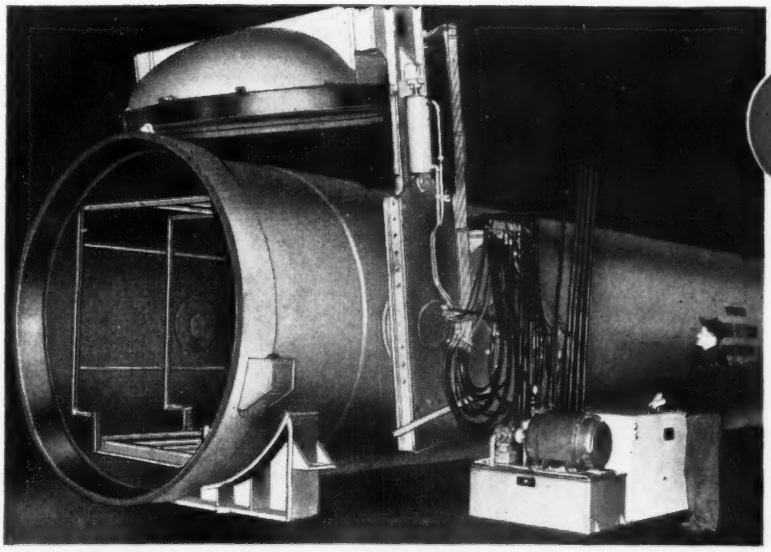
HYDROUS AND ANHYDROUS ALUMINUM SILICATE PIGMENTS, KAOLIN CLAYS, "ANTISUN" SUN CHECKING AGENT, PLASTICIZERS, RECLAIM PROCESSING OILS, GILSONITE COMPOUNDS, CURE ACTIVATORS.

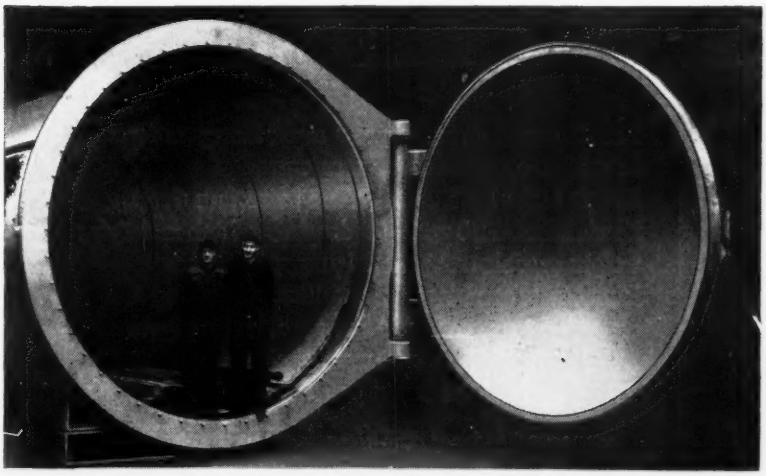


Quick Opening Doors

TO MEET ALL CODE REQUIREMENTS FOR PRESSURE OR VACUUM



10'0" Dia. x 75' Lg. Autoclave, with overhead hydraulically-operated Quick Opening Door with automatic safety features, and for manual or automatic valve operation



12' Dia. x 28' Lg. Vulcanizer, with manually operated Quick Opening Door.

Struthers Wells

All Welded Design, for Manual or Hydraulic Operation

Designed for the ultimate in simplicity of operation for pressure or vacuum vessels, or a combination of both. SWC Quick Opening Doors make possible easier handling, faster opening and closing, and a lifetime of reliability.

Doors can be furnished in the conventional hinged type, or for opening overhead, as illustrated.

The hinged door, manually operated, is mounted on anti-friction bearings requiring a minimum of effort for opening or closing.

The overhead door, which is hydraulically operated throughout, offers the additional advantage of substantial savings in floor space. This door can be provided with controls for complete automatic operation, or with manually operated hydraulic valves for semi-automatic operation. In either case, safety features are incorporated in the hydraulic circuit.

All doors are held in the closed position by a patented locking ring which requires no bolts. The locking ring is actuated by means of a hydraulic cylinder expanding the ring into the door frame groove for locking, and contracting the ring to open the door.

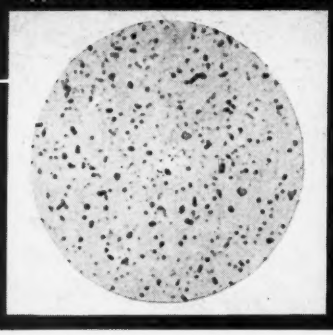
For complete description, write for our bulletin T-1200.

STRUTHERS WELLS CORPORATION

Process Equipment Division • **TITUSVILLE, PA.**

Plants at Titusville, Pa. • Warren, Pa. • *Offices in Principal Cities*

Magnification 1500X
Approx. Scale: 1 Micron = 1/16 in.



NOW AVAILABLE

A fast-curing, fine particle size zinc oxide specially surface treated to insure rapid and complete dispersion in rubber.

ST. JOE BLACK LABEL #20-21

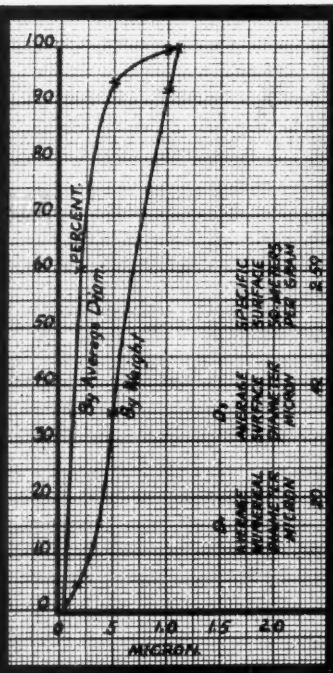
Representative Chemical Tests

ZnO	99.00%
Pb	.03
Cd	.01
Mn	.003
Cu	.002
Acidity as SO_3	—*
Total S as SO_2	.05
H_2O soluble salts	—*
Insoluble in HCl	.15
Loss at 110° C.	.30
Organic Material	.25

**Hydrophobic. Cannot be determined by normal methods.*

Representative Physical Tests

Particle size	
Average numerical diameter D_1 — microns	.20
Average surface diameter D_s —microns	.42
Specific surface—Sq.M./gram	2.59
Percent fines under .50 micron	35.0
Specific gravity	5.65
Apparent density—lb./cu. ft.	30.
Cleanliness	
Percent thru 325 mesh screen	99.97



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NEW YORK CITY 17

Plant & Laboratory: Monaca (Josephtown) Pa.

For improved dispersion and rapid incorporation in rubber compounds we recommend **Black Label #20-21.** Made by surface treating Black Label #20 with a hydrophobic, high molecular weight organic ester, this high quality St. Joe Zinc Oxide combines the excellent reinforcing and activating properties of a fine particle size pigment with the rapid dispersion characteristics usually associated with the larger particle size types.

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- LIGHT COLOR
- STABLE
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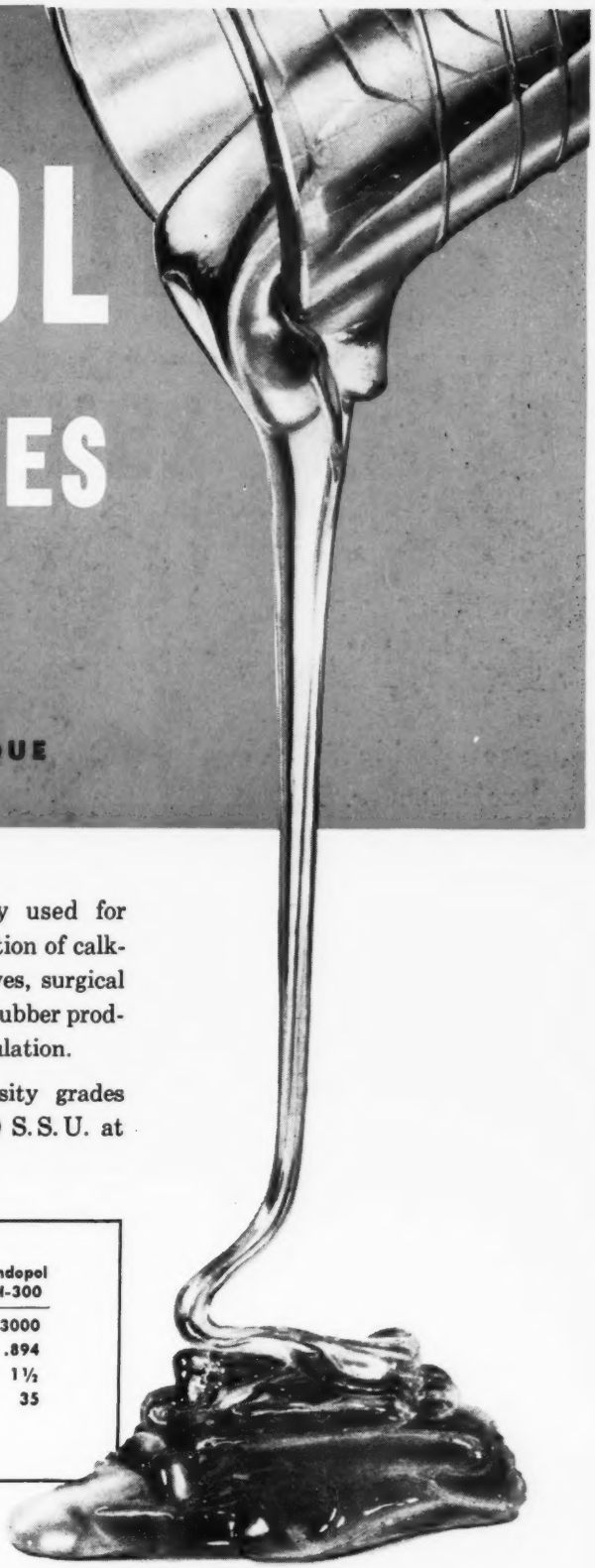

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Dependable supply in seven viscosity grades from 100 S.S.U. at 100° F. to 3000 S.S.U. at 210° F.

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Viscosity 210° F., Saybolt sec.	1040	3000
Specific gravity 60°/60° F.	.881	.894
Color, NPA	1	1½
Pour Point (ASTM) °F.	20	35

Additional lower viscosity grades are available.

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INDOIL CHEMICAL COMPANY

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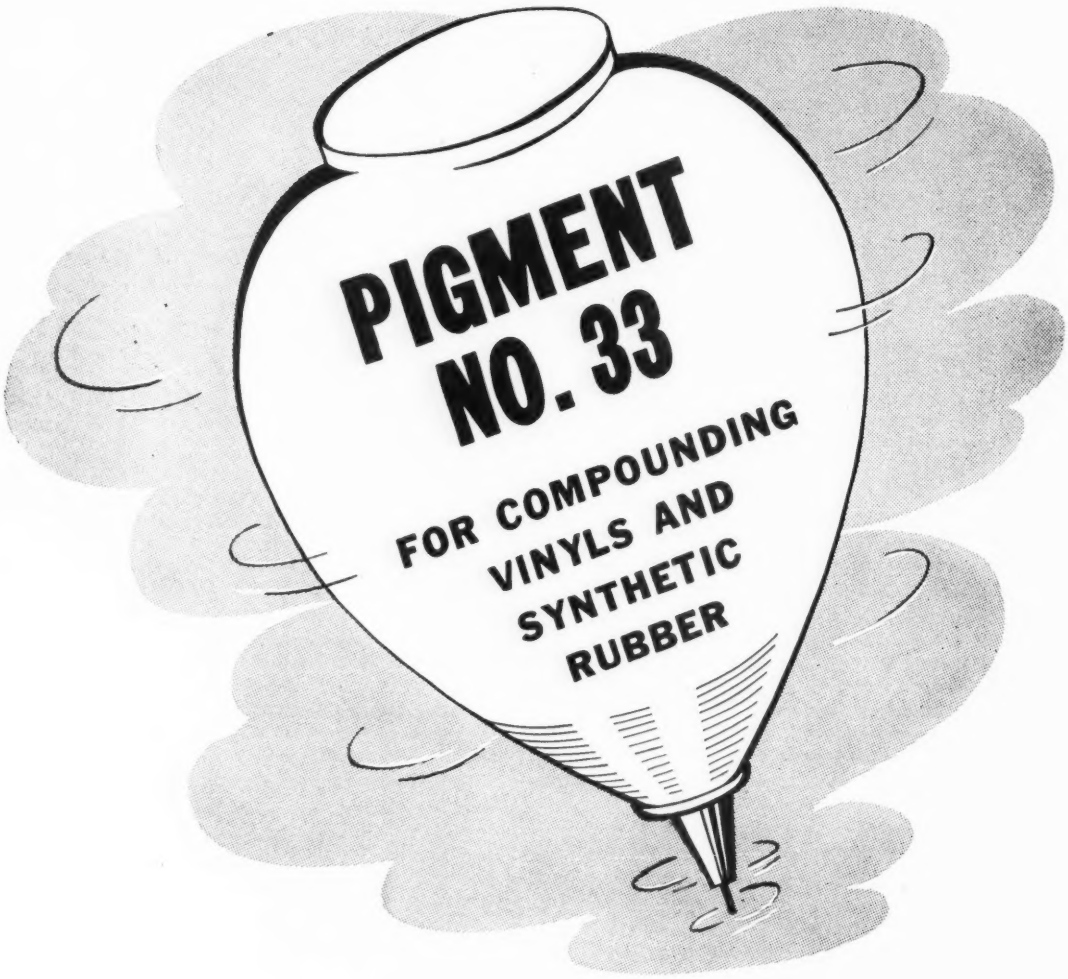

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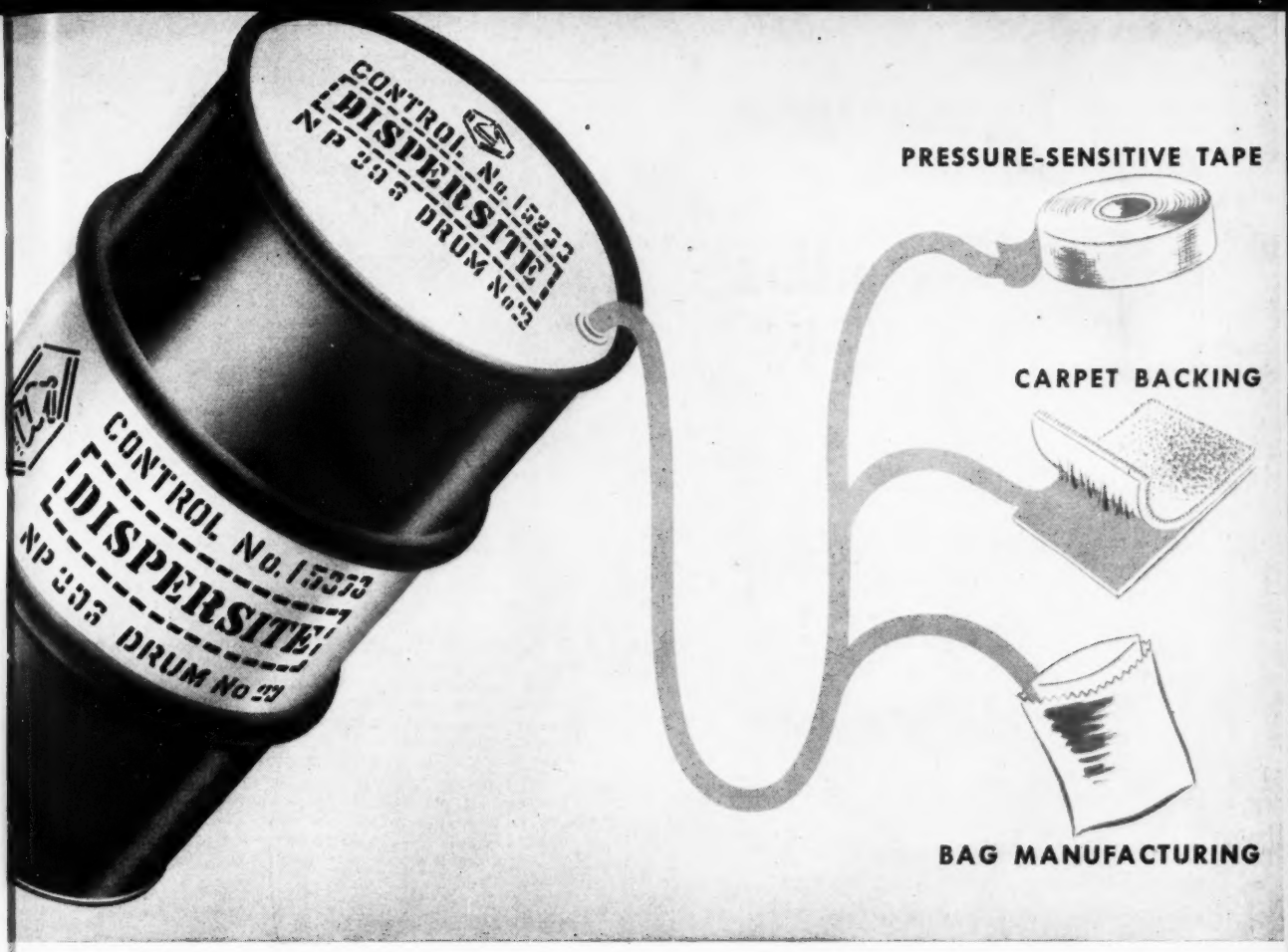

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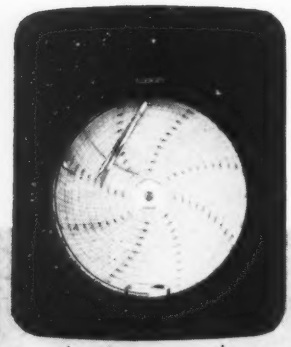
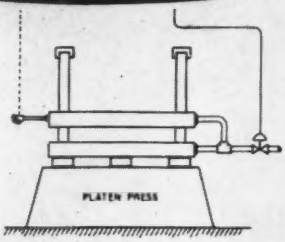


within 1/4° F!



Schematic diagram shows Dynalog Temperature Control on direct steam heated 3' x 3' platen press. Surface Temperature of platen is measured by resistance bulb at left. Steam supply controlled by Foxboro Dynalog M/40 Hyper-Reset Controller (top).

Production line platens can now be temperature-controlled within limits that used to be achieved only in the laboratory!

The key to this performance is the Foxboro Dynalog Temperature Controller, an instrument that's ruggedly built for continuous production use, yet so sensitive that it provides a change of valve position on temperature changes as small as .0015°F.

Installations of Dynalog Control on platen presses in two leading rubber mills are providing new uniformity and quality of product. See reproduction of actual chart below.

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INSTRUMENTS THAT IMPROVE PRODUCT UNIFORMITY

The Institution of the Rubber Industry

LONDON

THE RUBBER INDUSTRY owes its development largely to scientific and technical research and the Institution was founded in 1921 to foster scientific and technical advancement and to disseminate the results.

THE INSTITUTION TODAY is the centre of a great fraternity of rubber manufacturers, scientists, technologists, research establishments, executives and students from every country whose object is the advancement of the cause of the rubber industry throughout the world.

OBJECTS: To promote corporate and concerted effort in the industry by bringing together all those engaged or interested in the various branches of science and technology on which the Industry is based and co-ordinating their respective contributions.

To promote the profession and practice of Rubber Technology.

To encourage the extension of scientific and technical education in the principles and details of rubber manufacture.

To maintain a scheme of Diplomas for the recognition of efficiency in knowledge of all branches of technology essential to the successful maintenance and development of rubber manufacture.

To arrange for the holding of meetings, the reading of papers and the giving of lectures with subsequent discussions and publication.

To foster the systematic study of scientific and technical problems involved in the various phases of the manufacture of natural and synthetic rubbers and rubber-like materials and their conversion into finished products.

To encourage original work and research dealing with the manufacture of rubbers.

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The Transactions: Bi-monthly record of scientific and technological investigations in the realm of rubber and its allied industries.

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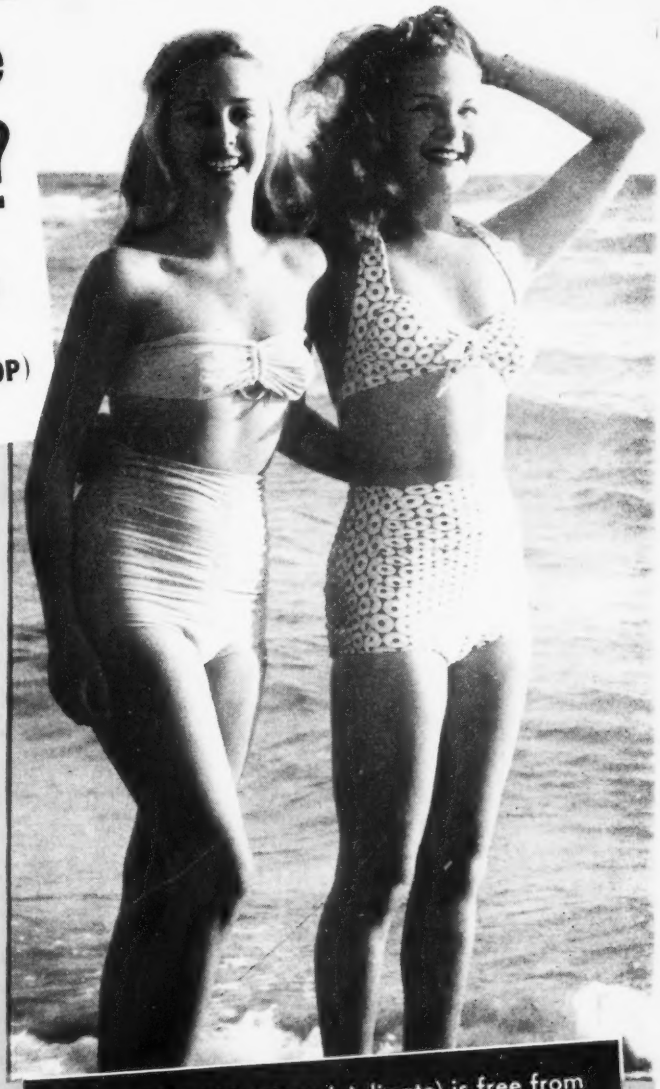
* POLYCIZERS 332 (DOA) and 162 (DOP)



Reduce production costs by using a lower plasticizer content or a higher filler load without impairing product quality . . . These "POLLY TWINS" will help you —

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Polycizer 332 improves heat resistance and permits higher loading without exceeding hardness requirements. It assures better low-temperature properties and good light stability . . . . For excellent general purpose plasticizing use Polycizer 162.

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POLYCIZER 332 (Dioctyl Adipate) is free from odor, low in acidity and practically colorless . . . Recommended as an entire or partial plasticizer in calendering, molding, extruding, organosol and plastisol processes.

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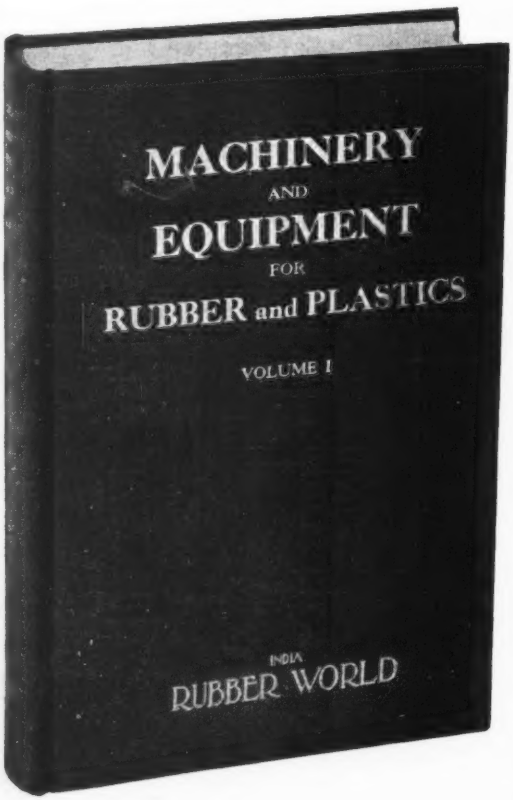

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VOLUME I

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Table of Contents

Chapter 1. Mills
Chapter 2. Mill Accessories
Chapter 3. Mixers
Chapter 4. Calenders & Accessories
Chapter 5. Extruders
Chapter 6. Extruder Accessories
Chapter 7. Presses, Compression
Chapter 8. Press Accessories
Chapter 9. Presses, Injection
Chapter 10. Molds & Mold Accessories
Chapter 11. Web Coating & Handling Equipment
Chapter 12. Pressure Vessels
Chapter 13. Heaters, Dryers and Coolers
Chapter 14. Tire & Tube Machinery
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Chapter 16. Footwear Machinery
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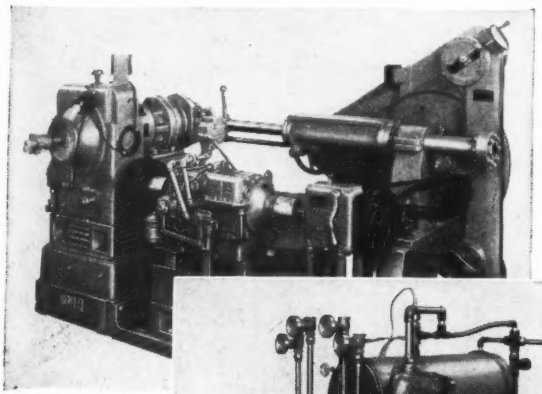

↑ Royle #2 (3¼") Continuous Vulcanizing Extruder for room temperature compound process.

→ Royle extruder temperature control unit utilizing steam and hot water.

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- Reduction in compound scrap
- Reduction in electrical faults
- Permits storage of completely mixed compounds
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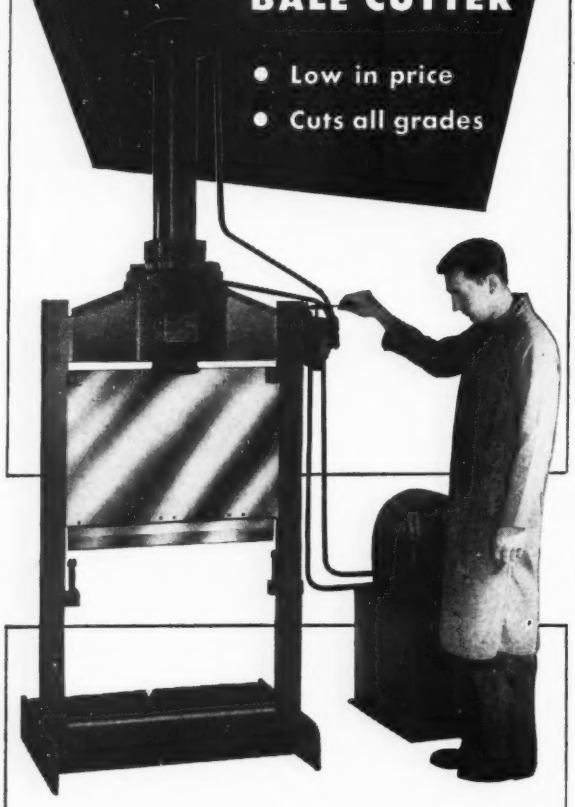

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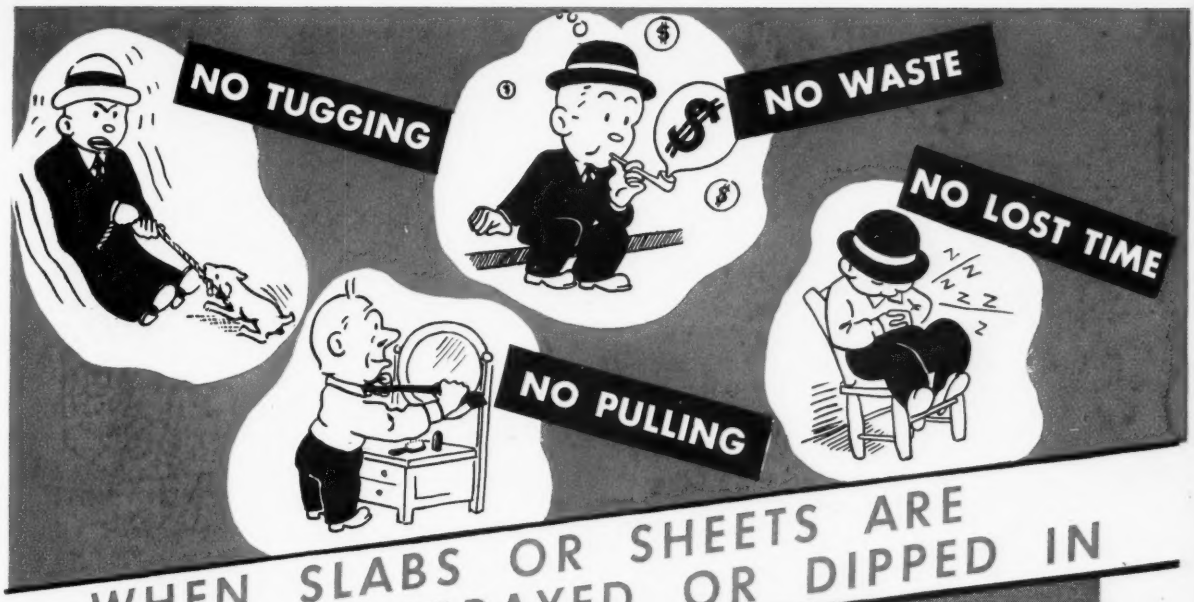

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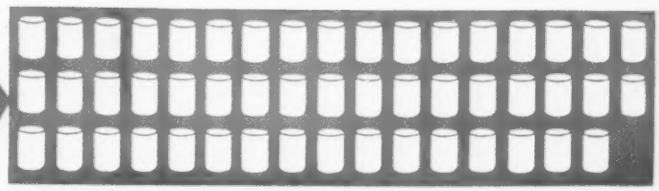

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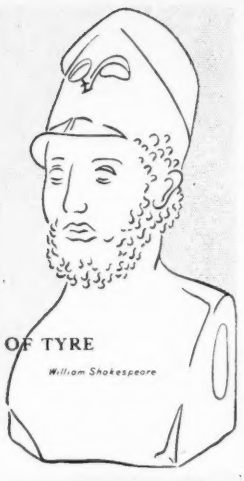

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William Shakespeare

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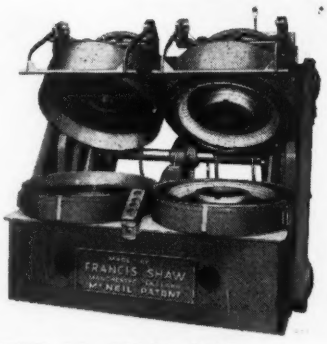

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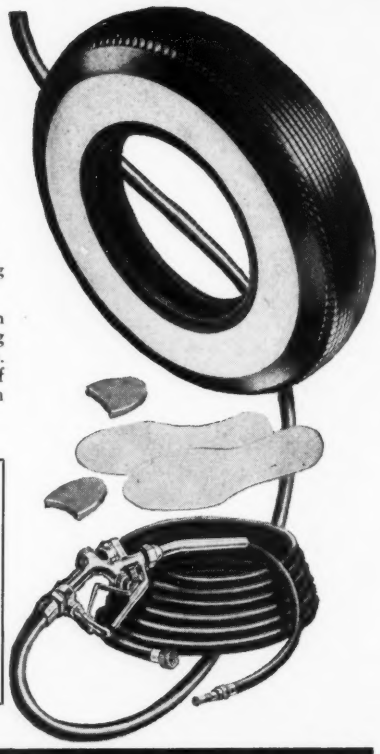

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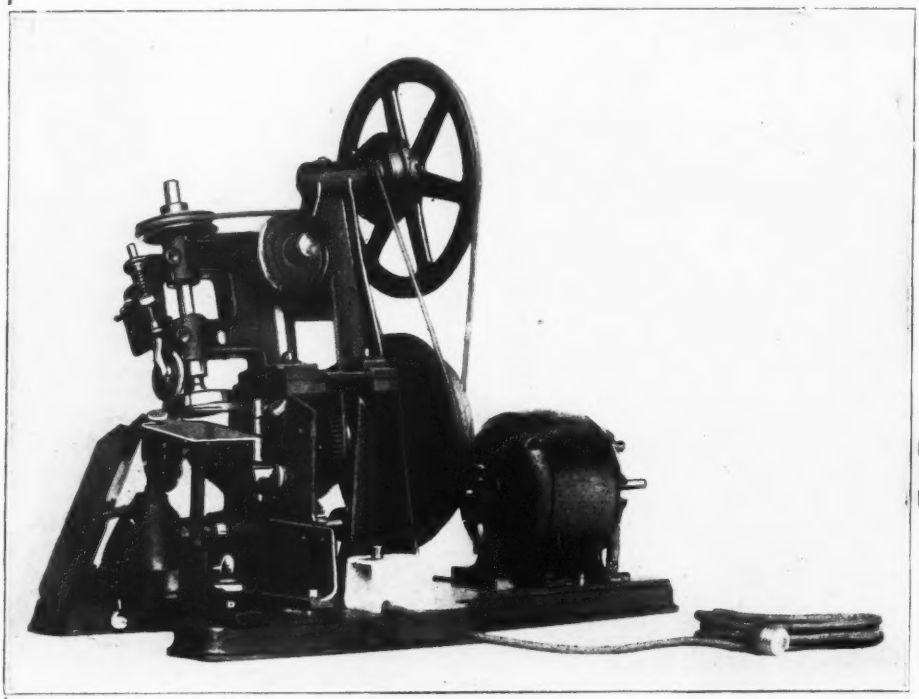

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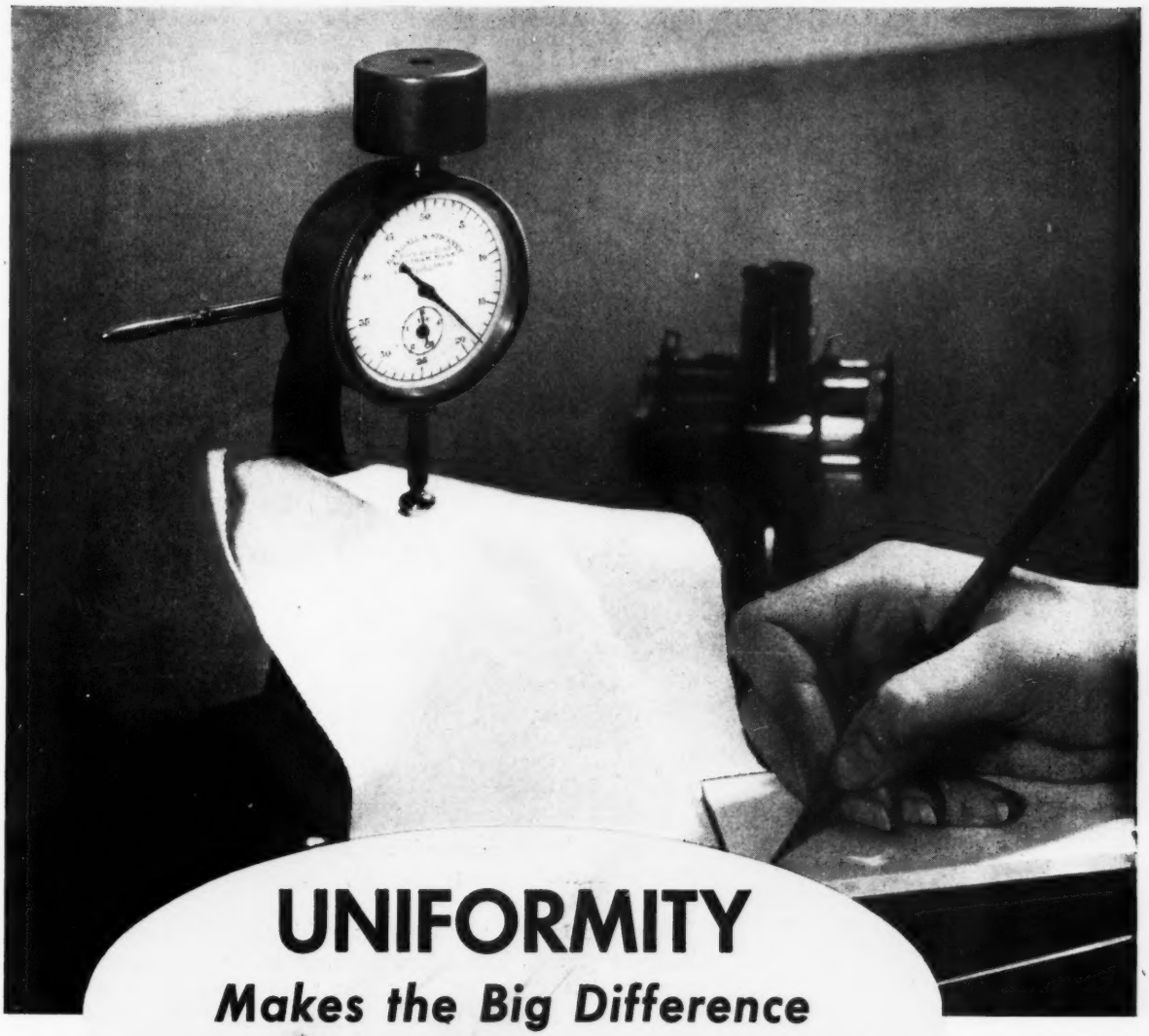

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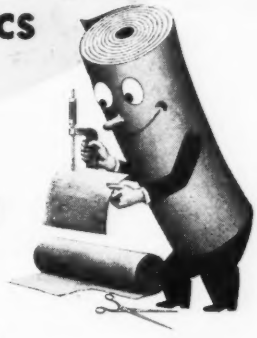

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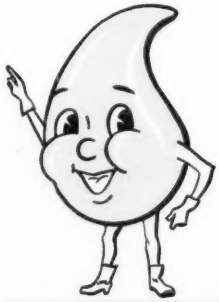

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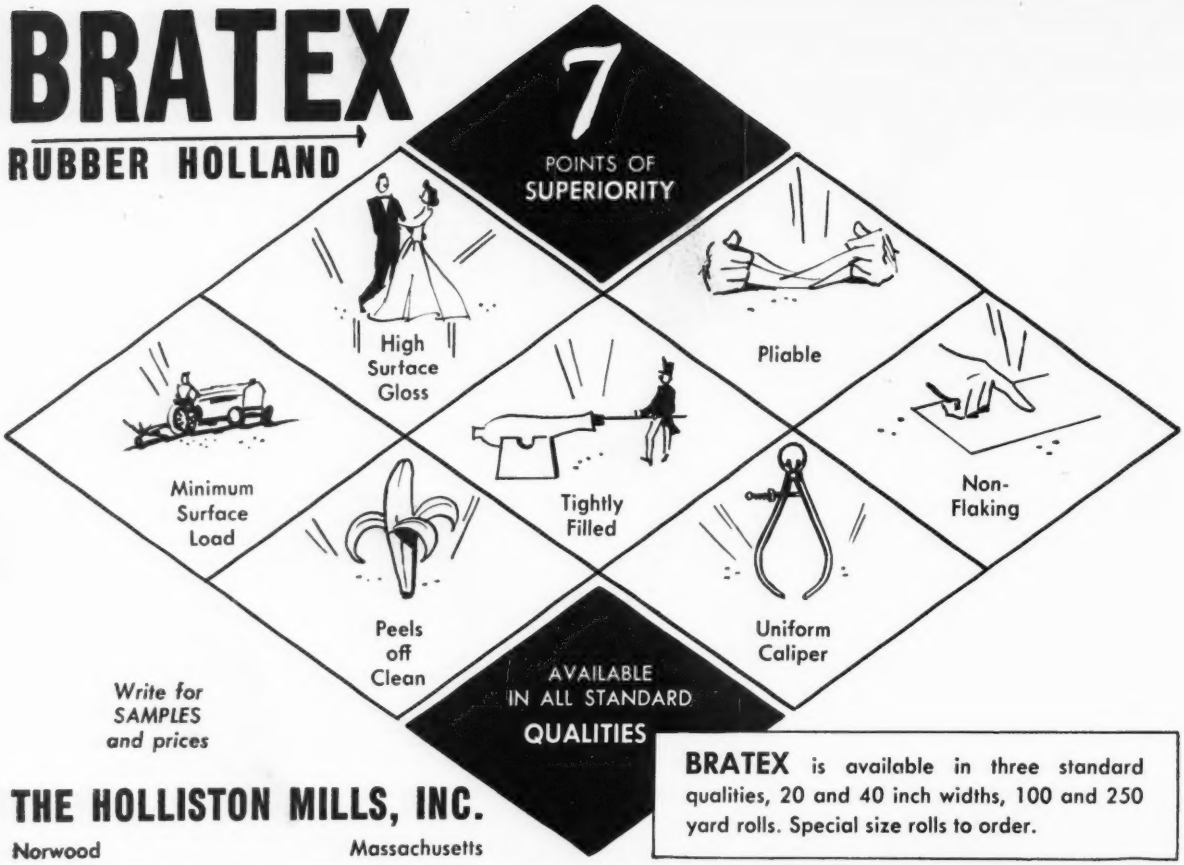

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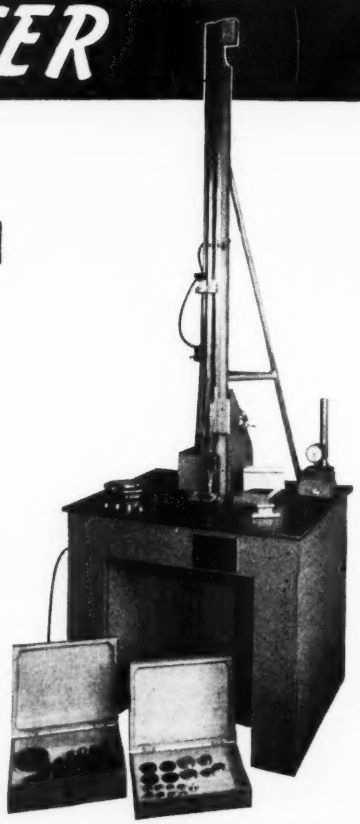

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Methods Employed in Compounding Research —I[1]

I. Drogin[2]

RESEARCH work in connection with compounding in the rubber industry may, according to Naunton (1),[3] be (a) fundamental, (b) technological, and (c) factory. Scott (2) has also brought in "operational research," which, as will be seen below, is essentially a part of the type of research called factory research by Naunton.

Fundamental research in connection with compounding is concerned with determining the basic nature of the polymers and compounding ingredients used. This type of research has for its objectives the determination of the structure of polymers and ingredients and the mechanism of the physical and chemical reactions between them.

Technological research has for its objectives the evaluation of the practical possibilities for use of a given type of rubber and/or compounding ingredient. In the studies connected with this type of research is the means of insuring that the work on fundamental research can be put to use. Technological research often establishes the direction of fundamental investigations while at the same time depending on these fundamental investigations for information with which to design new products or improve old ones.

Factory research is really what is also known as production control. It deals with quality and product control, the reduction of raw material and process costs, reduction in defective stocks, and improvement in factory processing and fabrication and also contributes to the development of new products.

There are various aspects to factory compounding research. If factory processing and fabrication are involved, the research may touch upon any one of the steps connected with the operations performed on the rubber from the start to the finished product. It may deal with the preparation of rubber and compounding materials, compounding and mixing of stocks, cord treating operations, molding, calendering, extruding, coating, building operations, metal adhesion, vulcanization, inspection, and shipping.

If the factory research is concerned with compounding ingredients, factors involved may be: reduction in raw material and process costs, source diversification for other raw materials, substitution of available material for those in short supply, and securing the maximum out of the purchase dollar.

If the factory research is, for the moment, centered on products, it may have for its objectives: improvement of old products, development of new products, and product control. If it is motivated by quality considerations, any one of the following factors might be of primary importance: quality specifications in terms of uniformity, setting up standards of quality, improvement in quality, and improvement in quality at equal or cheaper cost. Factory research has for its objective a good bit of the time the reduction in the amount of defective stocks. Also, it may be concerned with meeting the service requirements for the products and with control of mill-room production to see that material that goes into the final product is up to specifications.

Operational research according to J. R. Scott (2) "is a scientific method of providing managements with data upon which to base executive decisions." The term operational research signifies "that the investigations are normally made on production operations as carried out in the factory and *not* by laboratory experiments." Operational research is called scientific "because an essential feature is that the basic observations, data, or other material are treated in a rigorous scientific manner to yield sound unbiased conclusions instead of risky subjective judgments, 'hunches,' or prejudiced personal views which all too often have formed the basis of important decisions."

The actual methods of operational research, according to Scott, consist essentially in the careful and detailed observation of processes and operations and collection of systematic records, and the analysis of these to find out whether the operations are being carried out as efficiently as possible.

The ultimate aim of operational research in industry "must be to improve its competitive power by one or more of the following means: (1) increasing production; (2) cheapening production; (3) improving quality of the finished product."

[1] Based on a paper presented before the Ontario Rubber Section, C.I.C., Toronto, Ont., Canada, Mar. 11, 1952; The Los Angeles Rubber Group Inc., Los Angeles, Calif., Apr. 1; and the Northern California Rubber Group, San Francisco, Calif., Apr. 10.

[2] Director of research, United Carbon Co., Charleston, W. Va.

[3] Numbers in parentheses refer to Bibliography items at the end of this installment.

Tools of Compounding Research

The most important factor in obtaining the correct approach toward compounding research is to consider compounding as a science and not as an art. The rubber industry grew up as an art wherein it was customary for a long time to appraise compounds chiefly on the basis of personal attitudes rather than on systematically organized facts. As indicated by Davis (3), the quality of compounds was judged by feeling, bending, and biting. According to Geer (4), the testing of cured compounds was largely done by "tooth and claw." Test pieces were chewed, and strips cut off, and their strength and rate of recovery estimated by stretching and twisting. At one time resistance to tear was determined by the hand method, resiliency by bounce, and the carbon black dispersion by the sheen of the stock.

Statistical Methods

One of the most important tools available for compounding research and one which has come into use comparatively recently is the application of statistical methods to the problems of industry. These methods may be used for the design and analysis of experiments and for the control of industrial processes and products.

In compounding research it is imperative to plan experiments strategically so that the maximum amount of data may be obtained from a minimum amount of work and with a known degree of precision. Properly planned experiments permit the evaluation of several variables at the same time and at the lowest cost. An illustration of this approach is found in the work done under the sponsorship of the Synthetic Rubber Division, Reconstruction Finance Corp. (5), wherein the relative merits of five types of rubber, when compounded with seven carbon blacks, were established.

The use of statistical methods in connection with the physical testing of rubber was emphasized by Heide (6), six years ago. Also Oladko wrote about the use of the control chart technique in connection with plasticity determinations at about the same time (7). Heide has since prepared a practical manual (8) on the use of statistical methods for the control of industrial processes. This book provides adequate training both in the use of the statistical methods required and in the practical and technical problems of applying them to factory processes.

Youden's (9) recent book will be of interest to those who want to plan and conduct an experiment so that the resulting data lead to sound conclusions. It was written for those who make measurements and interpret experiments.

Technological advances, according to Newton (10), are generally based on the difference between two separate experiments, one involving the new feature; while the other is a "control" using the old feature. Technologists in the rubber industry have now become accustomed to the utility and, in many cases, even the necessity of employing statistical methods for determining the "meaning" of such differences between their experimental results. Thus it is well known that the "errors" of the experiment must be found before a decision can be taken whether or not the observed difference could reasonably be attributed to the "errors."

Definitions and Other Information

Another important factor in compounding research is to have a clear understanding of various technical terms so that they mean the same thing to all concerned. For example, Schade (11), in discussing the subject of vulcanization, deems it of importance to define the terms: "vulcanization, state of cure, times tor equivalent cure, optimum cure, best technical cure, rate of cure, and level of cure."

Also, Moses and Rodde (12), in discussing the testing of GR-S polymers for pigmenting, discoloring, and staining properties, consider the definition of these terms important.

The liberal exchange of all types of technical information among compounders was found to be of great value during the last war when great strides in rubber and rubber goods manufacturing were made possible by the very free exchange of technical information. The pooling of brains and experience materially reduced duplication of effort and expedited the solution of many a difficult compounding problem.

The prompt publication of the results of compounding research is of much help to all compounders in their research problems.

In general, however, the literature of rubber chemistry and technology abounds in basic information helpful to compounding research. In this country, publications of the American Chemical Society, *"Industrial and Engineering Chemistry"* and *"Rubber Chemistry and Technology,"* in particular, the rubber trade journals, India RUBBER WORLD and *Rubber Age*, the *American Society for Testing Materials Bulletin*, publications of the American Society of Mechanical Engineers, and publication of papers given before the 14 local rubber groups sponsored by the Division of Rubber Chemistry, A. C. S., provide a wealth of valuable information.[4]

In addition to this more or less formalized type of publication, the many technical bulletins and data sheets furnished by the suppliers of compounding ingredients to the rubber industry, contain much practical and useful information.[5]

The recently organized library of the Division of Rubber Chemistry, A. C. S., (13) should be a great help to compounders as a central point for the location of desired technical information from all of these sources.

The search for data on rubber compounds presents a difficult problem because of the variety of ways in which they may be recorded. With the continually accelerated pace of scientific research and of accumulation of results from this research, the problem of recording and indexing data is becoming more and more acute.

K. S. Rostler has developed a system—"The Rubber Formulary" (14)—of recording data on rubber compounds in an easily accessible form. The Formulary takes advantage of recently developed punched card systems (15) and records data on rubber compounds according to the specific properties by the marginal notches. By means of these notches and regular marginal holes it is possible with the aid of a special needle to separate the cards having the desired data from the other cards by a simple manual operation.

Standard Samples for Compounding

Standard samples of some of the major rubber compounding ingredients are available from the National Bureau of Standards, Washington, D. C., and should be used in compounding research whenever possible.

The use of such standard samples for the testing of rubber was inaugurated in 1943 by the Committee on Specifications for Synthetic Rubbers of what was then the Office of Rubber Reserve, RFC. The development

[4] The list of foreign publications dealing with rubber technology, such as *India Rubber Journal, Rubber Age and Synthetics* (London), *Transactions of the Institution of the Rubber Industry, Revue Générale du Caoutchouc, Kautschuk und Gummi*, is long, and complete details are beyond the scope of this paper.

[5] Special mention should also be made of the regular publications of some supplier companies, such as *The Vanderbilt News*, of R. T. Vanderbilt Co., and the *Neoprene Notebook*, of E. I. du Pont de Nemours & Co., Inc.

(Left)

Fig. 1. National Bureau of Standards Strain Tester (Scott Testers, Inc., Model)

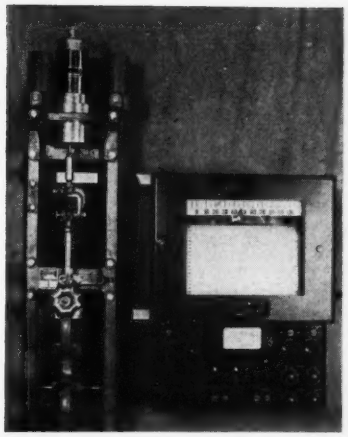

Fig. 2. The Accr-O-Meter (Scott Testers, Inc.)

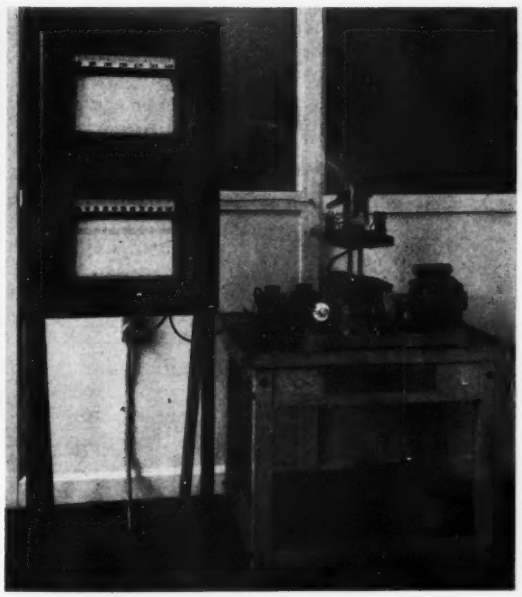

Fig. 3. The Mooney Viscometer (Scott Testers, Inc.)

and the use of these samples were an important part of the government synthetic rubber program, and the work of this Committee resulted in outstanding improvements in the precision and accuracy of the physical testing of rubber in the synthetic rubber plants. The uniformity of synthetic rubber production in recent years has been made possible by the improvements in the testing of rubber (16).

As an outgrowth of the successful use of standard samples of rubber compounding ingredients in the government synthetic rubber program, the National Bureau of Standards has added nine of these standards to the long list of standard samples supplied to industrial and scientific laboratories (17). The requirements of the specifications for government synthetic rubbers are now predicated on the use of these standard samples for stress-strain testing. The samples are also available to manufacturers of rubber products for use in connection with the procurement of raw materials, process control, and inspection of product quality.

Orders for these materials should be sent to the National Bureau of Standards, Washington 25, D. C., accompanied by payment in advance made out to the National Bureau of Standards. The following standards samples of rubber compounding ingredients are available:

Standard Sample No.	Material
370	Zinc oxide
371	Sulfur
372	Stearic acid
373	Benzothiazyl disulfide
374	Tetramethyl thiuram disulfide
375-B	Channel carbon black
376	Light magnesium oxide
377	Phenyl beta naphthylamine
378	Oil furnace type carbon black

General Techniques

It is important in compounding research to know, when a new material has been found of interest in preliminary trials, whether it is representative of the material to be supplied later on a commercial basis.

For example, the Synthetic Rubber Division, RFC, when considering a new source of HAF carbon black for use in masterbatches, stipulated that the sample of the black to be submitted as representative of a commercial shipment should be a composite of samples taken over a period of ten days' carbon black production. One of the GR-S plants masterbatching carbon black requires that all new sources of black must submit five samples collected at four-day intervals in order to check uniformity.

Also, in the appraising of new compounding ingredients, it has been customary sometimes to use such ingredients in compounds without making other changes in the formulation. Examples of this approach were the compounding and processing of synthetic rubber in the same manner as natural rubber, or the treatment of cold rubber and hot rubber alike, or the compounding of oil enriched rubber in the same manner as regular GR-S. The same error has been made in the evaluation work on new pigments. Compounders at first attempted to formulate HAF carbon black in the same manner as channel black. Non-black pigments, such as the fine particle size silica pigment (Hi-Sil) or the ultra-fine calcium carbonates such as Purecal, and other new compounding ingredients were used without making the necessary changes in the compound formula.

One important aspect of this problem in connection with the evaluation of either inert or reinforcing materials is the proper consideration of their oil absorption capacity because oil absorption is intimately related to the particle size, structure, surface condition, etc., of the material. Compounders will find it advantageous to consider this fact in pigment evaluation work.

Then there is the matter of the necessity of establishing different formulations for those compounds intended for factory production, as compared with those designed to emphasize differences in specifications. Factory-type recipes should repress as many variables as possible; while recipes designed to emphasize specifications should accentuate differences. The approach to such formulations is quite different, and very likely compounders sometimes overlook this very important point.

Improved Testing Equipment and Techniques

There have been several improvements in testing equipment and techniques for rubber in the last few years that are of special interest to those doing compounding

research. One of these is the development of the strain test for the evaluation of rubber compounds (18).

NBS Strain Test

In this test a predetermined load is applied to a specimen, and the elongation is measured after the load has been applied for a specific time. The load is selected to produce a specific force per unit of cross-sectional area of the unstretched specimen. With this equipment routine determinations of a point on the stress-strain curve can be made with greater accuracy and precision than has hitherto been possible with the usual stress-strain equipment. (See Figure 1.)

The strain test is of great potential advantage in compounding research for developing compounds of predetermined state of cure. It gives complete cure data which, according to Schade (19), can be treated mathematically and thereby eliminate the personal element in the interpretation of the data.

The mathematical relation discovered between time of cure and elongation of a test strip under specified load seems to offer a solution to the problem of determining quickly and accurately the relative curing rates and states of cure of different polymers and compounds. Equations relating time of cure and elongation of rubber compounds held under a fixed load enable compounders to calculate the rate of change of elongation for any time of cure, $\frac{dE}{dt}$, and the corresponding acceleration of the rate change, $\frac{d^2E}{dt^2}$. It also becomes possible to calculate times of equivalent cure of different compounds by equations relating time of cure with these two criteria.

The test is very sensitive in showing differences in cure rate and has been utilized by the Bureau of Standards to pick up differences in mixing techniques where laboratory mill temperature has varied by 2° F.

The Accr-O-Meter

Another example of improvement in testing equipment is the recently announced new force measuring device known as the Accr-O-Meter for connection to any standard Scott tester of the constant-rate-of-traverse type (20). The new device uses an unbonded strain gage to enable the technician to study materials under conditions of accuracy and sensitivity of a very high order of magnitude. The plot of the test is continuously and simultaneously drawn upon a strip chart recorder capable of magnifying small differentials in a manner convenient for evaluation to a maximum degree. (See Figure 2.)

The load measuring head is a small, compact, rigid assembly composed of the strain gage and the interchangeable force divider (elastic spool) and means of connecting the assembly to the framing of Scott's standard instruments of the constant-rate-of-traverse type.

The force divider (spool) acts as a stiff spring and is mechanically mounted in such a way that its extension is only 0.0015 of an inch at full rated capacity. This linear motion is transmitted mechanically to a strain gage of the unbonded type, which in turn converts its mechanical motion into a proportional and equivalent electrical signal that is then passed through the control panel to the interpreting mechanisms of the recorder.

The unique feature of the Accr-O-Meter is that the force dividers of all capacities offered are readily interchangeable within the weighing head. Mechanically, the measuring head is designed to measure the force upon its center line and upon that of the sample. The recording mechanism is a specialized modification of a commercial-type potentiometer recorder. The controlled signal transmitted by the strain gage causes the pen to move horizontally a distance proportional to the load, and this trace is the direct stress component of the record. At the same time the chart is driven at a speed synchronized to the pulling clamp of the testing instrument and becomes the strain component of the record. These two factors together result in a permanent stress-strain curve of the test performed from which ultimate tensile strength, yield point, elastic limit, modulus, and other variables may be discerned by the technician.

By judicious use of the zero controls and, when necessary, by the high-low range switch in addition, it is possible to test simply from zero to break, or in some cases past ultimate strength with a decrease of load to zero; expand the first fraction (as small as 1/10 of capacity) of the curve to full span, and observe the remainder without magnification; remove unwanted portions of the curve and plot a significant portion full width upon the chart.

Mooney Viscosity Measurements

Mooney viscosity determinations can be greatly improved, according to Taylor (21), by a more comprehensive standardization of machine specifications and by strict adherence to well-defined operating procedures. The variability of results obtained in different laboratories is undoubtedly due to differences in one or more of the following factors: (a) dimensions of the die cavity and of the rotor; (b) die closure adjustments; (c) calibration; (d) temperature regulation; (e) practices followed in cleaning the instrument; and (f) methods of sample preparation.

The general considerations in Mooney viscometer operations are discussed at length by Taylor and Veith (22), temperature measurements by Taylor and Ball (23), effect of variations in rotors by Decker and Roth (24), and adjustments of die closure by Decker (25). Taylor and Veith point out that the Mooney viscometer is capable of doing a good job of evaluating the processing characteristics of rubbers, but all too frequently, however, the user fails to understand the necessity of strict adherence to operational details if meaningful data are to be obtained. (Figure 3 is an illustration of a current model of the Mooney viscometer with recorder attached.)

The Mod-U-Meter

Another new piece of test equipment which serves as a tool for compounding research is the Firestone Mod-U-Meter for measuring rubber stiffness. Heretofore the elastic properties of rubber compounds have been largely determined by measuring the penetration of a spring loaded point below the surface of the sample to which the point is applied. The result has been expressed on several different types of scales, but in most cases had been termed "hardness." A new instrument has been developed by Brown (26) to enable a true measure of the elastic load deflection properties of rubber and rubber-like materials in compression to be determined. This instrument, called the Mod-U-Meter, is convenient to use and is especially valuable in checking individual batches of rubber products, during and subsequent to production operations, where the application of the product requires accurate elastic load carrying properties.

The Mod-U-Meter, see Figure 4, consists of a "U" shaped spring with a dial micrometer across the open

end to indicate the deflection resulting from a compression of the sample by closing the handle of a hand punch to which the spring is attached. The cylindrical sample is molded ½-inch in depth with a ½ square inch area (27). Deflection is limited by stops to any desired percentage of initial depth or length. The indicator is graduated in psi. resulting from the percentage deflection used. A compensator is built into the apparatus to allow for differences in shrinkage between various compounds.

In every-day use, according to Cooper (28), the factory curing molds for certain products are provided with a cylindrical cavity, approximately ½-inch deep and with an area of ½ square inch, to produce the sample. The rubber product is provided with an excess of stock that will flow into this cavity as well as into the cavity of the product being made. The product and the test pellet are cured under the same conditions, and any variations affecting the cure of the product are also a part of the cure cycle of the test pellet. After the mold has been opened, it will be found that the small cylindrical pellet adheres to the regular production item by means of a small thin overflow rind; thus the part and its check sample are integral.

Usual practice is to measure the sample from each part with the Mod-U-Meter before the product is released for finishing. This procedure permits the production of rubber parts such as springs, motor mounts, etc., with comparable and uniform elastic properties, and does this without destroying or even flexing the part.

The Mod-U-Meter lends itself very well to evaluating decay under load or the tendency of a stock to flow under compression, resulting in lower compression modulus figures after a given time interval. Most rubber parts used in compression are subjected to load for considerable periods of time rather than only for instantaneous loading, and this fact must be taken into consideration when the rubber part is being designed.

Temperature Control in Molding

Wide variations are frequently found in the physical properties of vulcanizates which were prepared from the same stock under what were considered to be the same conditions of time and temperature. The variations are usually associated with a difference in the state of cure of the vulcanizates. A possible source of these variations in physical properties is variation in the mold temperature during the curing cycle.

Molds are generally loaded and unloaded on a press apron or bench, with little consideration being given to the temperature change of the mold during this operation. Shrader and Keen (29), have indicated the temperature variations which may be expected from a typical molding operation and have suggested means of minimizing these variations. The rate of heat transfer from the press platen to the mold is often overlooked when the mold temperature is considered.

The importance of proper press insulation had been emphasized previously by Bimmerman (30), who showed that a temperature difference of 4° F. existed between the bottom and the top platens of a three-platen press in the absence of insulation between the bottom platen and the ram cap. The mold temperature drop can be reduced approximately 50% by insulating the mold from the press apron or bench and may also be controlled within limits by standardizing the time the mold is out of the press between cures. The control laboratories of the GR-S plants are equipping curing presses so that the temperature of the molds can be controlled within 0.1° F., thereby significantly improving the uniformity of the properties of the samples cured.

It might also be mentioned at this time that improved

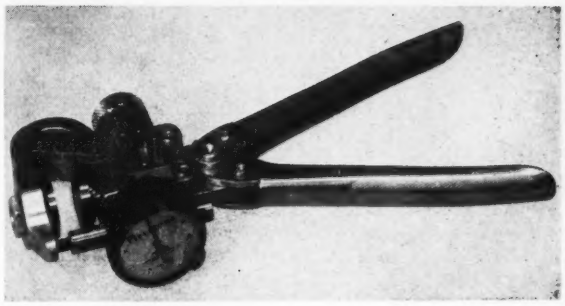

Fig. 4. The Firestone Mod-U-Meter

control of humidity conditions during the mixing and testing of rubber stocks will improve the uniformity of the test results. Rupert and Gage (31) have reported on the effect of atmospheric humidity on GR-S. Roth and Glime (32) reported on the effects of humidity during the storage of vulcanizates of GR-S and GR-S-10 on their elongations at constant stress. It is known that the moisture content of compounding ingredients and stocks affect the rate of cure of the stocks, and this variable has not received sufficient consideration.

According to Braendle and Wiegand (33), the moisture content of uncured GR-S compounds must be taken into account because of the effect on curing rate. Rush (34) states that moisture does not affect the physical properties of mill mixed GR-S stocks, but may result in improved processing characteristics and physical properties of the vulcanizates. In a report to the Synthetic Rubber Division, RFC, (35) on the effect of moisture on processing and cure of GR-S tire compounds, it is shown that GR-S tread and carcass compounds with 3% water content cure about twice as fast as when there is no water in the stocks. These results indicate that storage conditions of uncured compounds may have a large effect on cured properties.

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(*Continued on page 78*)

Further Extracts from Paley Commission Report on Coal and Petroleum Chemicals and Products Made Therefrom—II[1]

WITHIN the last 25 years hydrocarbons from petroleum and natural gas have become a source of raw materials for more than 2,500 different chemical products. With our increasing population and expanding economy, increasing mechanization, travel, transportation, and military demands, we shall require much more natural gas and petroleum in the future both for energy and for chemicals. There appears to be no serious problem, however, of inadequate hydrocarbon reserves. Our proved crude oil reserves have increased in spite of increased yearly production. Our ultimate oil reserves under the United States land areas may range between 500 and 1,000 billion barrels and—if we include the United States continental shelves—our ultimate reserves may be doubled. Our natural gas reserves have been very conservatively estimated at 500 trillion cubic feet.

Chemical Intermediates

The quantities of paraffins, olefins, aromatics, and sulfur which would be available for chemical conversion were calculated on the basis of an estimated petroleum production of 2.5 billion barrels in 1955, 3.0 billion in 1960, and 4.5 billion barrels in 1975; and on an estimated natural gas production of 9.2 trillion cubic feet in 1955, 11.4 trillion cubic feet in 1960, and 18 trillion cubic feet in 1975. The estimated availability of intermediates for chemical conversion in the years 1955, 1960, and 1975 was estimated first in millions of cubic feet per day—or millions of gallons per day as the case required. These estimates[2] were then converted to millions of pounds per year. They are shown in Table 1.

TABLE 1. HYDROCARBON INTERMEDIATES AVAILABLE FOR CHEMICAL CONVERSION, 1950-75

(Million Pounds)

	1950	1955	1960	1975
Paraffins:				
Methane	92,400	118,500	129,000	222,600
Ethane	24,950	26,820	28,300	38,450
Propane	23,700	27,150	30,400	40,650
Butane	21,224	26,100	30,900	45,500
Olefins:				
Ethylene	21,800	24,300	26,900	34,000
Propylene	25,400	28,600	32,100	42,500
n-Butylenes / Isobutylenes	25,000	30,700	36,200	52,800
Aromatics:				
Benzene	.....	9,350	11,760	18,950
Toluene	.....	18,340	22,980	36,900
C_8 Hydrocarbons (o, m, and p-xylenes, and ethylbenzene)	.....	23,470	28,520	42,260
Sulfur (from petroleum and natural gas)	1,440	1,748	2,026	2,850

The following paragraphs summarize briefly the methodology of the estimates given in Table 1.

Availability of paraffins was calculated on the basis of amounts present in natural gas, in gaseous products resulting from the thermal and catalytic cracking of gas oils, and from the thermal reforming of gasolines. Assuming that 65% of natural gas will be used as fuel, the paraffins available in natural gas are calculated as only 35% of the total natural gas production. Availability of olefins was calculated on the basis of amounts available from the gaseous products obtained in the thermal and catalytic cracking of gas oils and in cracking the corresponding paraffins obtained from refinery gases and natural gas.

Ethylene ordinarily is not recovered from the refinery gases as an individual product. It is separated along with ethane, and the resulting mixture is then cracked, or it is obtained by cracking propane. It is obtained also by cracking gas oils by special processes designed for them.

From the total availability of propylene, the amount required for polymer gasoline was deducted. This (polymer) requirement was calculated on the basis of present capacity for producing 35,000 barrels per day of nonselective polymer and on an assumption that 55% of the polymer came from propylene and 45% from butylenes.

From the availability of butylenes the amounts required for polymer gasoline and alkylate (for aviation fuel) were deducted.

The availability of aromatics was calculated on the basis of amounts available from United States petroleum and natural gasoline produced only by direct recovery and by platforming. An average was taken of the hydrocarbon composition of 140 to 185° F. fractions from seven straight-run gasolines from different parts of the United States, and it was assumed that these fractions constitute around 25% of United States crude oils. An assumption of an 80% conversion of naphthenes to aromatics gave a total benzene availability in United States crude oils of about 0.85%. In calculating yields

[1] The President's Materials Policy Commission Report of June 23, 1952. U. S. Government Printing Office, Washington, D. C. (Continued from our Sept., 1952, issue, pp. 777-81.)

This section, Chapter 13, is a condensation of a study made for the Commission by Gustav Egloff on natural gas and petroleum as industrial raw materials. The study reviews the history and statistics of petroleum and natural gas production as far back as available records permit and then projects reserves and requirements into the future. This condensation omits the historical data available elsewhere and summarizes Dr. Egloff's projections and discussions. Here we are concerned entirely with hydrocarbons as raw materials for industry.

[2] In both "Forecasts for Petroleum Chemicals," by Standard Oil Development Co., and "Oil and Gas as Industrial Raw Materials," by Gustav Egloff, the assumption has been made that any increases over present requirements for the raw materials to make the various end-products projected in each of these reports would come from petroleum or natural gas. In the case of "Coal Products and Chemicals," by Koppers Co., however, estimates are given showing how much of certain of these raw materials could be expected to be produced as by-products from coke production, and how much more could be obtained if coal hydrogenation developed to a stated extent during the next 25 years. The petroleum and natural gas requirements, therefore, represent the extreme quantities that would be needed should no additional material come from the coke industry. The actual quantities which will be produced from the petroleum and natural gas industry on the one hand, and the by-product coke and coal hydrogenation industry on the other, will be determined by the cost factors which are not presently predictable.

ot toluene and C_8 hydrocarbons it was assumed that the toluene availability would be twice that of benzene, and the C_8 hydrocarbons three times the amount of benzene. In calculating the aromatics available from natural gasoline the composition of Permian basin gasoline was used. The conversion factor for natural gasoline to benzene was the same as that used in calculating the yields of benzene from petroleum.

Insufficient data were available for calculating the average amount of sulfur (H_2S) in the natural gases in the United States. It was assumed that they contained 1% and that all H_2S could be recovered by the treatment of total gas production. The estimates of H_2S recoverable from thermal cracking assumed that the average charge to thermal cracking plants in the United States was 20 A. P. I. gravity with a sulfur content of 1.2%. Thermal reforming was ignored. An A. P. I. gravity of 29 and a sulfur content of 1.5% was assumed in calculating the sulfur available in the gases from catalytic cracking. Here, too, catalytic reforming was ignored.

Methane A Basis for Many Chemicals

Methane is the principal constituent of natural gas. Its chemical uses include the production of methanol, formaldehyde, methyl and methylene chlorides, carbon bisulfide, hydrogen (and subsequently ammonia), hydrogen cyanide, and synthesis gas (hydrogen and carbon monoxide). It will also be used extensively to produce acetylene.

Methanol is derived principally from synthesis gas, though a small amount is produced in other ways. Its chief uses are as antifreeze and as raw material for fomaldehyde manufacture. Some formaldehyde is also produced by direct oxidation of methane and as a by-product of the Fischer-Tropsch synthesis of hydrocarbons. Its chief use is in plastics production, which is growing rapidly. About 1.5 billion pounds of methanol and 1.8 billion of 37% formaldehyde is indicated as the production for 1955, as compared with 902 million and 835 million pounds, respectively, in 1950.

Methyl chloride, methylene dichloride, and small quantities of chloroform and carbon tetrachloride are made by chlorination of pure methanol. The demand in 1951 for methyl chloride of about 42,591,000 pounds was some five million pounds above expected production. Its main uses other than for silicone and other synthetic rubbers is as a refrigerant. It is useful as a solvent for insecticide bombs. Methyl chloride production may increase to 55 million pounds by 1955 and possibly 100 million or more between 1965 and 1975.

Methylene dichloride is also in short supply. It is used in safety films, in synthesis, as a refrigerant, and in metal cleaners. Production in 1950 was 39.7 million pounds, and this may increase by 1954 to 60 million pounds.

Hydrogen cyanide is now being produced from methane and ammonia, instead of entirely from sodamide and carbon as previously. In 1950 production from methane was seven million pounds out of a total production of 56 million. By the end of 1951 it was 50 out of 93.5 million pounds, and by the end of 1952 it is expected to be 130 out of a total of 191.5 million pounds. New capacity is chiefly for meeting requirements for production of acrylonitrile, utilized in synthetic fibers. Great expansion of production is expected in this field.

Carbon bisulfide is now being produced to a minor extent from methane and sulfur though most of it is still made from carbon and sulfur. Largest user is viscose rayon; carbon tetrachloride ranks next, and cellophane third. An important, but lesser volume use is in rubber accelerators. Although rayon demand is not increasing rapidly, the other uses are. Carbon tetrachloride production was about 40 million pounds below estimated requirements of 260 million pounds in 1951. Its use in Freon-type propellants and refrigerants is increasing rapidly.

Ammonia is synthesized by reforming natural gas with steam to give hydrogen, which is then reacted with nitrogen. At present more than 50% of the capacity is based on natural gas, the balance on coke. The demand for ammonia is growing rapidly; total production of synthetic ammonia in 1950 was seven times that in 1939. Increasing amounts of ammonia will be needed not only for growing requirements for fertilizer, but also to keep up with the rapid growth of the chemical industry.

Acetylene is now being produced from methane. One plant is operating, and another is soon to operate. Formerly the entire acetylene production was from calcium carbide made from lime and coke. The present process depends on the partial oxidation of methane with oxygen. Another one in development subjects natural gas to pyrolysis in a regenerative furnace. The proportion of future production from natural gas will depend on cost factors, especially power costs.

Acetylene is in short supply, and the demand is increasing. In addition to its use in welding, it is a raw material for vinyl chloride and acetate and for neoprene rubber. About 300 million pounds were used in 1950 for chemicals. Entirely new uses are developing based on the Reppe syntheses.

Ethane is present both in cracked gases from petroleum refining and in natural gas (about 7%). It is usually not separated, but used with methane for direct oxidation reactions. The gas is used in a mixture of cracked gases for ethylene production. However, for chlorination to ethyl chloride (used chiefly in lead tetraethyl) it is separated from the cracked gases.

Propane is also present in natural gas (about 4%) and in cracked gases from petroleum. It may be left in the natural gas along with the other gases in oxidation reactions. But it is separated alone or with butane to give liquefied petroleum gas (LPG), which is primarily used for heating and domestic purposes though some is used for chemical conversion. Propane from cracked gases is used largely for ethylene production. Small amounts of nitromethane, nitroethane, and 1- and 2-nitropropane are produced by nitration of propane, and increasing production over the next few years is probable.

Propane is one of the most important raw materials for chemicals, and requirements will continue to rise for many years to come on the basis of known products and processes alone.

Normal and isobutane are present in natural and cracked gases from petroleum refining. The normal butane in natural gas (about 1.5%) is ordinarily used for chemical conversion admixed with other natural gas constituents or separated as LPG. The butanes are isolated from other components, however, for dehydrogenation to the corresponding butylenes, which are mainly used for aviation gasoline and synthetic rubber manufacture.

Pentanes are obtained from natural gasoline. For chemicals production they are converted to amyl chlorides which are intermediates for amyl alcohols, amyl amines, and amyl naphthalenes. These have uses as solvents, dye intermediates, wetting agents, corrosion inhibitors, insecticides, plasticizers, heat transfer media, etc. Although not in large volume production, these derivatives have many specific applications, for which requirements will increase.

The higher paraffins, found in kerosene and paraffin wax fractions, have a number of uses in chemical manufacture. They are oxidized to alcohols, aldehydes, and ketones, and the oxidized products are used as oil additives, wetting agents, plasticizers, etc. The paraffin wax is oxidized to higher acids. Chlorinated paraffin compounds from kerosene are intermediates for pressure lubricants and for alkylation of benzene to produce detergents.

Demands Outstrip Supply for Ethylene Products

The commercial production of ethylene is generally integrated with other refinery operations. Ethane and propane gases obtained from gasoline manufacturing, or from natural gas, are subjected to high-temperature cracking. Another method cracks selected fractions of gas oil. Recovery is effected by low-temperature, high-pressure fractionation and low-temperature absorption.

Demand exceeds supply for a number of ethylene-based products and may continue to do so for a number of years to come. The extent of possible new markets cannot be estimated, but will probably be more than adequate to assure continued utilization of any surplus production presently envisioned. Expansion of many chemical processes now in use, an increased dependence on petrochemical materials, and new product development will accelerate the rate of growth. Total requirements estimated for ethylene based on its maximum use as a source of its products are (millions of pounds) 1950, 1,536; 1955, 3,550; 1960, 5,220; 1975, 10,400. If some of the ethylene is replaced by carhohydrate derived ethyl alcohol or by acetylene, the estimate would be 1955, 2,550; 1960, 3,700; 1975, 7,000. If quantities of ethylene beyond those available from expanded gasoline refinery operations are required, processes specifically designed for ethylene will become important. A number of such processes are known and include an autothermic process involving partial oxidation with air, a regenerative cracking process, and some catalytic processes. One of the latter (Catarole) is now in use in England.

Ethylene's chief use is as a raw material for organic chemical manufacture. In 1950 the following products were produced utilizing the amounts of ethylene shown (millions of pounds): ethylene oxide, 483; ethyl alcohol, 495; ethylbenzene, 173; ethyl chloride, 137; ethylene dichloride, 90; ethylene dibromide, 30; polyethylene, 55; other chemicals, 73.

Ethylene oxide itself is a fumigant, but its chief use is as an intermediate. In 1950 the chief products obtained from it and the amounts of ethylene consumed in each (million of pounds) were as follows: ethylene glycol, 338; glycol ethers, 54; ethanolamines, 27.5; acrylonitrile, 24.5; detergents, 19; others 20.

Ethylene glycol has had a phenomenal growth which will probably continue for a long time. Its major use is in antifreeze, but it is also used in making polyglycols for detergents and explosives, as well as being one of the raw materials for the new fiber, Dacron. Also the glycol ethers and the ethanolamines made from it have a wide range of uses.

Acrylonitrile produced from ethylene via ethylene oxide increased tenfold in consumption from 1941 to 1945 as a result of the high demand for synthetic rubbers. The new development of acrylic fibers forecasts an almost unlimited future for this material. It is, however, also produced from acetylene, and the role of ethylene in future increased production will depend on the comparative economics of the two processes.

The acrylate esters can also be produced via ethylene and ethylene oxide. The major production comes from acetone. They are chiefly used for plastics and have many uses in wartime aviation.

Other Ethylene Compounds

Ethyl alcohol surpasses ethylene oxide as a consumer of ethylene. In 1950 about 57.5% of the alcohol production was derived from ethylene. On the basis of 60% production of ethyl alcohol from ethylene more than 800 million pounds of ethylene will be required by 1955 and more than two billion by 1975 for ethyl alcohol production. In case of war an additional 100 to 200 million pounds of ethylene would be needed for ethyl alcohol production.

Ethyl benzene, produced from ethylene and benzene, is used chiefly to produce styrene for GR-S synthetic rubber and for polystyrene plastics. Although rubber requirements are being met, there is a rapidly increasing market for polystyrene.

Ethyl chloride is a growing market for ethylene. Most of present production is made for ethylene and hydrochloric acid. It is used principally for tetraethyl lead manufacture. It has other minor uses. Production in 1950 was 350 million pounds. Increases will depend to a large extent on the course of the market for tetraethyl lead.

Ethylene dichloride, made from ethylene and chlorine, is also used chiefly in connection with tetraethyl lead, but has use as a solvent and as an intermediate for vinyl chloride production. Production in 1950 totaled 304 million pounds, requiring 90 million pounds of ethylene. Requirements will increase with tetraethyl lead and vinyl resin consumption. The latter have more than doubled in the last five years. With planned expansion, total production will be increased about 20% to reach 500 million pounds per year. Increase in vinyl chloride may, however, come partially from acetylene as a base rather than from ethylene.

Ethylene dibromide, of which 180 million pounds were made in 1950, requiring 30 million pounds of ethylene, is used chiefly with tetraethyl lead. It has some minor uses as a solvent and intermediate for dyes and as a possible fumigant.

Polyethylene, an unusually versatile plastic made from ethylene, reached a production of 55 million pounds in 1950. It has one of the very largest potential markets of any of the plastics. It is useful in insulation, in radio, television, and electronic equipment, and in packaging films, cups, plates, and containers. It is replacing cosmetic containers of glass and resists corrosion by many reagents including hydrogen fluoride. A production of at least 200 million pounds by 1955 could be utilized and, unless some far superior materials are developed in the meantime, the one-billion-pound mark could be reached before 1975.

Propylene Products

Propylene is extracted from petroleum cracking gases; a total of 882 million pounds was produced in 1950. Its major use is for production of isopropyl alcohol, of which one billion pounds were produced in 1950. Much more could be produced from propane in natural gas.

Isopropyl alcohol is in high demand. Its consumption has closely paralleled our industrial growth. Almost 75% is used as a raw material for acetone production. It has many other and increasing uses such as in rubbing alcohol, lacquer solvent, antifreeze, cosmetics, vitamin crystallization, etc.

Glycerin is produced to some extent from propylene. Of a total glycerin production of 200 million pounds per year, 40 million pounds are produced from propylene, and this amount is being expanded to 60 million. Propylene

glycol is also produced from propylene, to the extent of 90 million pounds per year.

Allyl chloride and allyl alcohol, important intermediates in certain types of plastics and coatings, are other products of propylene, and likewise, dichloropropane-dichloropropylene mixtures (D-D), useful as soil fumigants.

The tetrapropylene polymer is another derivative of propylene and is used to alkylate benzene for production of detergents.

Cumene from propylene is also of high potential significance. Recently a process for producing phenol and acetone simultaneously was developed with cumene as the starting material. It requires neither chlorine nor sulfuric acid, both of which are in short supply.

Butylene Forms

Butylenes are recovered from gases of petroleum cracking and also by catalytic dehydrogenation of the butanes. Principal uses are for synthetic rubber, alkylation and polymerization to aviation gasoline components, and for alcohols or other chemicals. Production of normal butylenes in 1950 was 904 million pounds, and of isobutylene, 124 million pounds.

Butadiene is the most important single product of the normal butylenes since it is used for making GR-S rubber, our major general-purpose synthetic rubber. Some is also used in preparing the N-type rubber (polybutadiene-acrylonitrile).

The secondary and tertiary butyl alcohols utilize the remainder of the normal and isobutylene production. They are used mainly as solvents for lacquers, paint removers, etc. Methyl ethyl ketone is perhaps the most important use of secondary butyl alcohol. Production was about 165 million pounds in 1951.

Higher Olefins

Higher olefins are present in the liquid fractions of cracked gasoline and oils. The heptenes are used as a starting material for the Oxo process for iso-octyl alcohol, which is of particular interest in production of di-iso-octyl phthalate, a plasticizer. Iso-octyl alcohol will also find wide use in detergents, anti-foaming agents, and organic syntheses. Application of the Oxo process to hexenes and nonenes will probably result in the commercial production of alcohols from these olefins.

Production of iso-octyl alcohol is at the rate of 30 million pounds per year, and two new plants will bring capacity to 50 million pounds.

Aromatic Chemicals

Benzene is produced from petroleum and natural gas by the catalytic reforming of six-carbon-atom naphthenes of gasolines. The first processes used for benzene were the hydroforming process and a two-stage process in which methylcyclopentane was catalytically isomerized to cyclohexane and then dehydrogenated to benzene. Many installations now under construction use the platforming process which combines these two steps. Additional catalytic processes have recently been announced. All these processes produce toluene and C_8 aromatics.

Requirements for benzene have risen rapidly and exceed the amounts available from coal-tar sources and imports. In 1951, 175 million gallons were produced from coke ovens, compared to 25 million from petroleum. Imports during 1951 were 50 million gallons. Obviously, great increases must come from petroleum and natural gas. Including plants now certified, rate of production from petroleum will reach 60 million gallons by mid-1952, 100 million by the end of 1952, and 130 million before 1954. It is expected that capacity based on petroleum will have to be increased by an additional 70 million gallons by 1955; and if imports are lost, by 120 million gallons.

Many times the amounts indicated are potentially available from present petroleum and natural gas production. Based on 1951 production of 2.1 billion barrels of petroleum and 120 million barrels of natural gasoline, 1,010 million gallons of benzene could potentially be made available. Estimating 2.5 billion barrels of petroleum and 200 million of natural gasoline for 1955, 1,270 million gallons of benzene could be obtained.

Major Consumers of Benzene

Styrene is the greatest consumer of benzene. It utilized 82 million gallons in 1951. It is estimated that requirements for styrene for polystyrene plastics will more than double between 1951 and 1955, but the demand for styrene for synthetic rubber may lessen due to a reduction in the styrene content of the rubber.

Phenol is the second largest consumer of benzene. Production in 1950 was 312 million pounds, against a consumption of 342 million. Ninety-five per cent. of present production is synthetic (e. g., benzene derived). The balance comes from coal tar. Estimated phenol requirements for 1955 are more than 550 million pounds.

Nylon is the third largest consumer of benzene. The present production of nylon is 100 million pounds per year. In 1951, consumption of benzene for its production amounted to 25 million gallons. A new plant to produce 50 million pounds per year is being built. The increase in benzene requirements to meet the growing demand for nylon will not be directly proportional. Other raw materials such as cyclohexane, butadiene, and furfural are also being used to some extent.

Aniline is the fourth largest market for benzene. In 1951 it consumed 16 million gallons. Aniline consumption, however, will follow along in proportion with the expansion of industry generally.

Detergents, the fifth largest market for benzene, are expanding rapidly. Total surface-active agent production in 1950 reached 676 million pounds, of which 373 million pounds were cyclic. About 16 million gallons of benzene were required for production needs in 1951, 18 million gallons are estimated for 1955, and by 1975 perhaps 40 million gallons.

DDT (dichlorodiphenyltrichloroethane) and benzene hexachloride consumed seven million gallons of benzene in 1950. It is estimated that for 1952 eight million gallons of benzene will be required for DDT and 8.6 million gallons for benzene hexachloride.

Maleic anhydride is made from benzene to the extent of 35 to 40% of its total production. In 1951, four million gallons of benzene were used for this purpose.

A number of intermediates are produced from benzene, including chlorobenzene, nitrobenzene, the diphenyls, and dichlorobenzene. They consumed six, four, three, and six million gallons of benzene, respectively, in 1951. Lesser consumers of benzene will require about 15 million gallons in 1951.

Toluene Akin to Benzene

Toluene is produced from petroleum and natural gas by the same processes as benzene, but the starting material is the seven-carbon-atom naphthenic fraction of gasolines. Published 1950 production was 83.9 million gallons, more than 45 million of which came from petroleum. Any quantities of toluene needed are potentially available from petroleum.

Among the new uses for toluene is the production of

(*Continued on page 78*)

O-Rings—An Annotated Bibliography

Betty Jo Clinebell[1]

With a Foreword by

E. N. Cunningham[2]

THE O-ring is a mature newcomer in the field of highly engineered mechanical goods. Manufacturers of O-rings consider themselves more in the category of specialyized engineering organizations than rubber companies.

The relationship to the rubber industry comes from the use of the same basic materials, mixing, stock preparation and molding processes. The point of distinction comes from the fact that compounds, molds, molding techniques and rubber processes must be modified and refined to meet an entirely new and exacting standard of precision. Dimensional tolerances are closer than for any other type of rubber molded product and mold register must be near perfection. Any defect which can be detected by individual visual inspection may be considered cause for rejection depending upon the service requirement standards for a particular quality O-ring.

The shape of the O-ring is a torus, or the solid of revolution produced by rotating a circle about a straight line axis lying in its plane. More specifically, the shape is that of an anchor ring.

The O-ring is used chiefly as a seal. The simplest application is the static seal where there are no moving parts. An example would be a flange to flange seal. See Figure 1. A properly dimensioned groove is cut in the face of one flange. The O-ring is located in this groove which provides the correct squeeze and permits the ring to move ahead of the pressure medium to seal against the mating flat face.

The moving seal is the most astonishing use of the O-ring. In one common form of this application the ring is located in a properly dimensioned groove in a piston and acts much the same as the piston ring in an automobile engine, sealing against the cylinder wall with the reciprocating motion. In some designs the ring rolls as the piston moves, in others it slides, but in both cases the ring moves ahead of the pressure medium to seal the gap or clearance between the piston and cylinder wall. Thus it is possible to have a piston cylinder action for either slow or fast motion where the leakage past the seal is negligible and provide a long service with relatively little wear on the moving parts.

Another application of this moving seal principle is the rod or shaft seal where the O-ring located in a groove in the cylinder seals against the reciprocating motion of the cylinder rod or a moving shaft.

Most applications where O-rings are used require that they be made from resilient materials serviceable over a wide temperature range. The oil resistant synthetic rubbers are used to the greatest extent but all types of rubber are used to some degree. Semi-rigid plastics have been used in some very special applications. Recently, an O-ring was developed which is a steel torus, hollow on the inside and containing gas at high pressure to provide a degree of resiliency.

The O-ring is well known by aircraft designers and came into prominency in aircraft designing and manufacture during World War II. Now O-rings are being applied to all types of equipment for all types of sealing problems. Aircraft designers were among the first of the engineering profession to become acquainted with the O-ring in its capacity as a hydraulic packing. The O-ring became a prominent factor in aircraft hydraulic equipment during World War II. Hydraulic mechanisms became the most efficient method for actuating landing gear, brakes, wing flaps, stabilizers, bomb bay doors, variable pitch propellors and many other mechanical functions requiring remote control with positive, safe, dependable, and instantaneous action.

The O-ring seal leaped into prominency because of its simplicity, effectiveness and the long fool-proof service life which it provided. The simplicity of design and groove dimensions reduced fabrication costs and made it possible to have compact hydraulic mechanisms such as the power steering devices now used on many trucks and passenger cars.

Installation is easy, all that is required is to machine a groove to the proper dimension tolerance and finish, snap the O-ring into place, lubricate and install. These operations all fit very nicely into any mass production or machine shop practice.

The range of its applications is from fountain pens to heavy earth moving equipment; from articulated artificial limbs to wing flaps on the huge bombers; from the winding stems on water-proof watches to cylinder seals on diesel locomotive engines. In every industry engineers are using the simplicity of the O-ring seal to provide a positive fool-proof seal.

—E.N.C.

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Gaskets for Use with Water, Gases, Air, Oil and Benzene. H. Diegmann, *Arch. Wärmewirt.*, 15, 210 (1934); *Chem. Abs.*, 28, 7075 (1934).

Materials, including rubber rings, are recommended for various services.

Packing the Centrifugal Pump. F. C. Thorn, *Ind. Eng. Chem.*, 31, 929 (1939).

A rotary seal type of packing is mentioned. A ring of rubber-fabric with the cloth plies at right angles to the rod is better than a ring of vulcanized rubber, because the voids within the cloth offer a slight opportunity for harmless expansion of the rubber layers.

Synthetic Rubber in Gland Packings. H. Diegmann, *Kunststoffe*, 31, 93 (1941).

[1] Librarian, Rubber Division Library, University of Akron, Akron, O.
[2] Precision Rubber Products Corp., Dayton, O.

The article opens with a general comparison of leather and synthetic rubber of the Buna type, in which the latter is shown to be superior. The design of a packing ring housed in metal is described.

Hydraulic Cylinders. J. E. Thompson, R. B. Campbell, *Product Eng.*, 13, 122 (1942); 274 (1942).

The design of hydraulic cylinders, with respect to cylinder bore, required stroke, piston design, end-cap sealing methods, end-cap design, swivel joints, dashpot design, and ring seal design is discussed. Synthetic rubber packing ring applications are illustrated.

Aircraft Experience Aids in Industrial Hydraulics. *Machine Design*, 15, 91-5 (Sept. 1943); 15, 100-4 (Oct. 1943).

Toroid rings are briefly mentioned.

O-Ring Packings Simplify Lightweight Hydraulic Equipment. *Product Eng.*, 15, 581 (1944).

Design of O-ring packings and glands, their advantages and limitations, are presented from experience, and standards developed for lightweight hydraulic equipment. Details of dimensional tolerances, materials, lubrication, finish of running surfaces, frictional characteristics, and causes of failure are given.

Selecting Hydraulic Seals. L. S. Linderoth, Jr., *Machine Design*, 16, 9, 119 (1944).

The O-ring packing is widely used as a piston-rod, piston and cylinder-head packing, as illustrated, also as a packing in swing check and poppet check valves, and as a seal for separating internal elements in complex hydraulic valves

Army-Navy-Aeronautical Specifications for "Packings and Gaskets; Hydraulic." AN-T-79 (1949) superseded by MIL-P-5516 (Jan., 1952). Available from Commanding General, Wright Air Development Center, Wright-Patterson Air Force Base, O.

O-Ring Packings Adapted for 3,000-Lb. Pressures. R. L. Hayman, *Product Eng.*, 16, 56 (1945).

This article describes a successful method of utilizing synthetic rubber O-rings in reciprocating hydraulic equipment at double the maximum pressure previously considered practical, and the method of testing such operation under adverse conditions.

Design of Hydraulic Systems. II. Packings and Their Applications. H. Field, Jr., *Ibid.*, 16, 100 (1945).

The problem of selecting a fluid seal or packing is discussed as to materials, types available, purpose of the seal, installation problems, and advantages and disadvantages of each type of packing. O-rings do not function well as rotary seals except for slow speeds.

Performance of O-Ring Packings in Rotary Seals for 3,000 Pressure. R. L. Hayman, *Ibid.*, 16, 190 (1945).

The fact that O-rings alone withstood 20,000 cycles of operation with no leakage is undoubtedly caused by the comparatively small angular motion plus the lack of high-frequency, large-amplitude pressure pulsations. Illustrations are included.

Sealing Points Free of Flash Eliminate Packing Ring Leakage. H. G. Wessel, *Am. Machinist*, 89, 122 (1945).

The method of placing parting line at 45-degree angle in mold cavity results in smooth surfaces for rubber ring seals. Details are given of improved mold construction procedure.

Investigation of 10-Degree Undercut Groove for O-Ring Packing. B. R. Vennum, Douglas Aircraft Co. Report SM-20063 (Dec. 10, 1945).

Performance of Houghton No. 2216 Back-up Rings with O-Rings on Large Struts at 3,000 P.S.I. Pressure. E. R. Broadbent, Douglas Aircraft Co. Report SM-11155 (Jan. 1, 1946).

Flexible Fluid Coupling Uses O-Ring Packings. *Product Eng.*, 17, 19 (1946).

Engineers of Lockheed Aircraft Corp. have found a solution to the problem of designing flexible couplings for fluid lines installed between a flexibly mounted aircraft engine and its supporting structure through the development of a mechanical flexible coupling using O-ring packings.

Seals for Preventing Oil Leakage in High-Speed Superchargers. Z. Fox, *Ibid.*, 17, 158 (1946).

Methods are described for preventing oil leakage through openings for shafts in gear cases and bearing housings of high-speed superchargers where pressure differentials exist across the seal. Design features and performance of ring, labyrinth, and contact types of oil seals are discussed, and their relative advantages compared.

Selecting Operating Pressures for Hydraulic Systems. H. Field, *Ibid.*, 17, 163 (1946).

Selection of pressure is discussed as to power required, size of units and available packings, pumps, cylinders, and valves.

Performance of Linear LT2-70 Hydraulic O-Ring Packing Used with Chrome Retanned Leather Back-up Rings at 3,000 P.S.I. Pressure. E. R. Broadbent, Douglas Aircraft Co. Report SM-11809 (Apr. 4, 1946).

Mechanical Seals. D. R. Lewis, *Machine Design*, 18, 9, 125; 10, 78; 11, 138; 12, 146 (1946).

O-rings are discussed in Part II, classification of types (p. 78), and Part III, application factors (p. 138).

Rubber-Ring Fastener. H. S. Sizer, *Ibid.*, 18, 10, 91 (1946).

Rubber-ring fasteners prove ideal for link pins subject to high shock loads. Rubber O-rings remained normal after 500,000 operations of solenoid linkage.

German Aircraft Hydraulic Systems and Their Components. R. H. Davies, *S. A. E. Journal*, 54, 418 (1946).

Packings were mostly U-cups, half U-cups, or modifications of these designs. Only in one instance were any O-rings seen, and then only in a few units.

Typical Methods of Sealing Rotating Shafts. *Product Eng.*, 17, 108 (1946).

Shaft seals, used to prevent seepage of lubricating oils or other liquids, range from simple flange packings to elaborate bellows and lapped-surface devices. The O-ring is included in this discussion.

O-Ring Seals in the Design of Hydraulic Mechanisms. D. R. Pearl, *S. A. E. Quarterly Trans.*, 1, 602 (1947).

O-ring seals have been found to be effective, dependable, and economical for both static and moving seal applications.

Hydraulic O-Ring Packing for Sealing Cylinders and Pistons. R. E. Allen, *Product Eng.*, 18, 163 (1947).

Groove designs for non-moving and moving types of O-ring seals in hydraulic units and other applications, sealing action of O-rings, and properties of compounds available for making O-rings are described.

O-Ring Seals. D. R. Pearl, *Machine Design*, 19, 5, 97 (1947).

O-ring seal merits and advantages are discussed. An investigation of the sealing and wearing characteristics of synthetic rubber O-ring seals for static, reciprocating, and rotating pistons is reported.

High-Temperature Face Seals. F. F. Ruhl, *Ibid.*, 20, 1, 127 (1948).

O-rings are included in this discussion of how hydraulic coupling and torque converter seals were developed. The design of successful high-temperature face seals is discussed.

Sealing Mechanism of Flexible Packings. C. M. White and D. F. Denny, Ministry of Supply, Scientfic & Technical Memorandum No. 3/47, His Majesty's Stationery Office, London, 1948. 112 pp.; *Summary of Current Literature*, 26, 570 (1948).

Comprehensive research on the properties in service of flexible packings designed to seal against a moving surface is discussed. It is shown how the pressure is distributed over the surface and how packings deform under pressure. Extrusion of the material into the clearance space occurs with rectangular, toroidal, and U-section packings when the pressure is sufficient. Means of reducing such extrusion were explored, and laws of lubrication were investigated.

Molding of O-Ring Packings. F. E. Clark, W. P. Ball, L. E. Cheyney, *Rubber Age (N. Y.)*, 62, 652 (1948).

Aircraft O-ring packings are made of oil-resistant synthetic rubber with the necessary low-temperature properties built into the compound. Possible methods of preparation of O-ring stock are included in this article.

Silicone Rubber: New Properties for Design Engineers. G. S. Irby, W. Goss, J. J Pyle, India RUBBER WORLD, 117, 605, 616 (1948).

Silicone rubber O-rings confined in a chamber under pressure to effect a seal have worked well in most cases, and they provide an effective oil and air vapor seal on the 7-G-180 jet engine when the temperature at the point of seal was 350-400° F. No swelling was observed from the effects of the oil vapor, and the gasket could be reused.

Hydraulic Seals. F. Flick, *Machine Design*, 20, 11, 139 (1948).

A tabulation gives operating characteristics of properly designed seal assemblies built to correct specifications. O-ring and chevron seals are not commonly used as piston seals on general-purpose cylinders. Although excellent for static seals where they have indefinite life, O-rings have limited life when used as moving seals.

Research on Aircraft Hydraulic Systems. T. J. McCuistion,

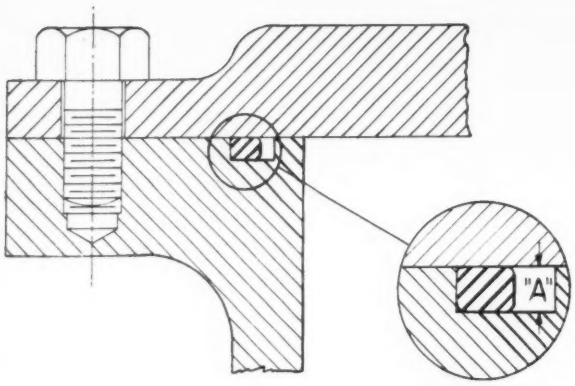

Fig. 1. Application of "O" ring to cylinder head covers, blind flanges, etc. This-type installation will hold high pressures without the excessive bolt stress necessary with conventional gasket joints. The "O" ring is automatically preloaded in the groove, and the nuts are tightened only enough to maintain metal-to-metal contact

F. E. Clark, R. A. Clark, L. E. Cheyney, *S. A. E. Quarterly Trans., 2, 227, 267* (1948).

This report of a survey of hydraulic packings, especially O-ring seals, covers friction studies, torsional strength tests, plasticizer development, a study of rubbers, molding technique, and spiral failure.

Compressor Crankshaft Mechanical Seals; A Review of Past and Present Practice. N. Tetlow, *Modern Refrig.*, 51, 8, 20, 34, 51, 68, 92, 97, 120 (1948). 14 diagrams.

The discussion includes the design, application, operating principles and classification, and construction of O-rings for refrigerant work. Where lubricant is used, synthetic rubber is used because of its resistance to deterioration in the presence of oil, and chemical resistance to all refrigerants used today.

Aircraft Hydraulic Systems—Factors Influencing Their Performance. L. E. Cheyney, T. J. McCuistion, *Mech. Eng.*, 70, 675 (1948).

Some of the variables affecting the performance of aircraft hydraulic packings are discussed.

Hydraulic Components. *Product Eng.*, 19, 9, 150 (1948).

An O-ring, molded by Parker Appliance Co., of a synthetic rubber compound of its own formulations, provides a perfect seal for the valve unit of a new, labor-saving floor-waxer.

Correct Use of O-Rings on Valve Seats. T. J. McCuistion, *Applied Hydraulics*, 1, 11 (1948).

Retaining-type grooves, used to prevent blow-outs, and methods of making are described.

Hydraulic Packing and Seals. C. E. Schmitz, *Ibid.*, 2, 1, 8 (1949); 2, 3, 14 (1949).

Part I of the survey discusses the compression and self-sealing types of packings, including new materials, available for hydraulic applications, including O-rings. Part II covers the construction and application factors of typical mechanical seals.

How to Eliminate the Problem of O-Ring Leakage. T. J. McCuistion, *Ibid.*, 2, 1, 14 (1949).

Practical pointers on the leakage problems encountered in the application and installation of O-rings and remedies for their control or elimination are given.

Hydraulic Seals; Rotary, Oscillating and Reciprocating Types. T. E. Beacham, F. H. Towler, *Proc. Inst. Mech. Engrs*, 160, 532 (1949); *Automobile Engr.*, 39, 202 (1949); *Power Trans.*, 18, 297, 383 (1949).

A survey is given of various sealing methods in which oil is the working medium in the hydraulic machinery. Detailed descriptions appear of packings with diagrams of spreader rings, piston rings, and O-rings.

Variability of a Typical Commercial Oil-Resistant Synthetic Rubber. C. L. Smith, L. E. Cheyney, *Rubber Age (N. Y.)*, 64, 575 (1949).

The most satisfactory synthetic rubber for use in the manufacture of O-rings for military aircraft is the nitrile rubber known as Perbunan 18.

Compounding of O-Ring Hydraulic Packings. R. A. Clark, L. E. Cheyney, *Ibid.*, 65, 531 (1949).

This paper is largely limited to compounding requirements for O-rings acting as seals between moving parts in aircraft hydraulic systems.

Development of High-Pressure Seals for AN Straight Thread Fittings. H. E. Cornish, J. C. Bloom, *Applied Hydraulics*, 2, 10, 18 (1949).

The design and testing of a new O-ring for AN straight thread fittings is given.

Hydraulic Packings for Industrial Equipment. J. N. Smith, *Machine Design*, 21, 12, 155 (1949).

Hydraulic and pneumatic packing standards for leather and synthetic rubber are given in tabular form.

Frictional Characteristics of O-Rings with a Typical Hydraulic Fluid. L. E. Cheyney, W. J. Mueller, R. E. Duval, *Trans. Am. Soc. Mech. Engrs.*, 72, 291 (1950).

A method for studying the friction of O-ring packings employed in aircraft hydraulic systems is described, and the effects of several variables, pressure, time, delay, squeeze, stroke speed, ring size, and surface finish of the moving metal part have been determined.

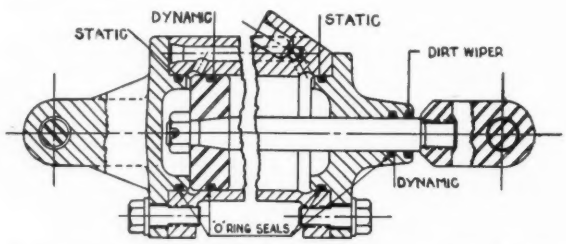

Fig. 2. This drawing of a 1,250 p.s.i. hydraulic cylinder shows how various "O" rings may be used for static and dynamic sealing applications

O- and V-Ring Packings in Industrial Hydraulics. J. H. Swartz, "Proceedings of the Sixth Meeting, National Conference on Industrial Hydraulics, 1950." Vol. IV, pp. 251-69. (Sponsored by the Graduate School, Illinois Institute of Technology, and Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill.)

The article discusses historical background, advantages and limitations of O-rings, design features and analyses of O-ring failures for different applications. Special O-ring installations (O-ring check or poppet valve, static sealing members on face-type shaft seals, and oscillating or rotating shaft seal), and compound selection for O-rings are included.

Theory and Practice in the Design of Hydraulic Seals. R. O. Isenberger, *Applied Hydraulics*, 3, 2, 22 (1950).

The use of O-rings either as static or dynamic seals for reciprocating motion on pistons or shafts is discussed. At pressures higher than 1500 p.s.i., O-rings should be used with back-up washers to prevent extrusion.

Silicone Materials with Emphasis on "Silastic." E. J. Smith, India Rubber World, 121, 439 (1950).[1]

New series of Silastic stocks which have been developed include stocks with low compression set for high-temperature gasket and O-ring use.

Rotary and Reciprocating Seals. V. Roger, *Technique Moderne*, May 1 and 15, 1950, pp. 149-53; *Summary of Current Literature*, 29, 787 (1951).

Seals intended to prevent leakage, as compared to labyrinth and similar types where some leakage is intended, are considered. Leather and rubber rings of the type used for reciprocating surfaces are compared.

Factors Influencing O-Ring Selection. T. J. McCuistion, R. E. Allen, *Applied Hydraulics*, 3, 5, 12 (1950).

Some design considerations and a list of points to check in the selection of O-ring compounds are given.

How to Choose the Proper Packing. H. C. Matheis, *Ibid.*, 3, 8, 22-4, 53 (1950).

O-rings are used as a single unit up to pressures of 1500 p.s.i. Many installations have been made at 5,000 p.s.i. or more, but lapped mating surfaces were required.

O-Ring Seals Standard Check Valve. *Product Eng.*, 21, 11, 189 (1950).

Circular seal check valves are being made available as standard items in a full range of sizes from ⅛-inch to one inch NPT. Two models are available designed for standard and very low pressure systems; both are poppet type using an O-ring seal. Absolute sealing, minimum flow resistance, and

[1] Abstract of paper.

leakproof dependability for pneumatic and hydraulic systems are claimed.

Packings for Hydraulic Equipment. G. N. Dorr, *Machinery*, 58, 1, 170 (1951).

Static and dynamic applications of O-rings are discussed. Tabular data are recorded for (1) recommended clearance between piston and cylinder when O-ring packing is used under various pressures, and (2) friction pressures exerted on O-rings of varying hardness at different working pressures.

How to Seal Rotating Shafts against High Pressure. W. Coopey, *Chem. Eng.*, 58, 116 (1951).

Two designs of lower seal elements using O-rings are described.

New Gland for Hydraulic Stop Valve Spindles. B. Cooke, *Engineer*, 191, 170 (1951).

The replacement of normal packed glands on valve spindles by sleeves fitted with O-ring seals is described.

Rubber O-Rings Display Low Compression Set. *Product Eng.*, *22*, 2, 166 (1951).

Considerable research and experimentation have resulted in the manufacture of precision O-rings that provide hydraulic seals resistant to petroleum oils and most hydrocarbons. They are efficient under static conditions at either high or low temperatures, even at temperatures of —65° F. and lower.

Silicone Rubber O-Rings. *Chemical Week*, 69, 18, 56 (1951).

This technical data sheet from Frederick S. Bacon Laboratories lists specifications and dimensions of silicone rubber O-rings which provide hydraulic seals resistant to petroleum oils and most hydrocarbons.

Synthetic Rubber O-Ring Seals. E. L. Carlotta, *Product Eng.*, *22*, 6, 130 (1951).

This comprehensive discussion includes a table listing the properties of O-ring materials along with a series of illustrations showing how O-rings perform satisfactorily in dynamic and static seal applications.

Using Mechanical Seals for Centrifugal Process Pumps. D. R. Rankin, *Heating, Piping, Air Conditioning*, 23, 10, 102 (1951).

Seals with O-rings or bellows of such materials can be used only below 250° F. The application of pump seals is discussed, and practical advice on their proper use in industrial processes is offered.

Design Recommendations for O-Ring Seals. J. H. Swartz, *Product Eng.*, *22*, 9, 162 (1951).

Rectangular grooves, a definite initial squeeze or interference of the ring, radial clearances of not more than one half the recommended O-ring squeeze are some of the design recommendations given.

Floating Gland Design for Long O-Ring Life. T. J. McCuistion, *Applied Hydraulics*, 4, 9, 59 (1951).

The actual design of the "floating" gland is investigated. The design presents an entirely new size relation of piston grooves and cylinder bores to packing sizes. The "floating" gland design opens up the possibility of using more than one O-ring in a gland so that a progressive wearing out of the seal can be accomplished.

Mechanical Seals Effective on Main-Line Pumps. M. J. Dabney, W. W. Holt, Jr., *Oil, Gas J.*, 49, 35 (1951).

The development and service testing of mechanical seals for large centrifugal pipe-line pumps to replace the soft metallic packing conventionally employed as a seal between pump case and rotating shaft are described.

Fluorescent Sensitized Photomultipliers for Heterochromatic Photometry in the Ultraviolet. F. S. Johnson, K. Watanabe, R. Tousey, *J. Optical Soc. of Am.*, 41, 10, 702 (1951).

Details of the method of sealing a photomultiplier to a vacuum system by an O-ring and a machined half cylinder appear.

Simple Ways to Seal Slow-Speed Bearings. *Mill & Factory*, 49, 109 (1951).

Commercial oil rings are used to seal slow-speed bearings where space is at a premium, where end-wise movement occurs, and where there are long, thin housings.

Technics in the Automatic Control of Low-Temperature Vacuum Food Concentration. L. W. Slater, E. R. Fehlberg, *Food Technol.*, 5, 11, 468 (1951).

The development of a so-called "dry" meter body, a sensitive opposed stainless steel bellows that could be substituted for the usual mercury meter body in differential pressure measurement, is discussed. O-rings are used for sealing.

Designing for Economical Gasketing. E. C. Frazier, *Product Eng.*, *22*, 7, 139 (1951).

A table lists gasketing materials with their properties, general uses, and typical joint designs. A list arranges the materials in ascending basic cost of the material. New gasketing materials are being developed, such as the silicones and other new rubber-like materials. O-rings are used for special design and assembly conditions, such as in square grooves permitting concentric sleeves or cylindrical shells to be assembled with a rolling gasket between.

A New Rotary Seal for High-Speed and High-Pressure Applications. T. J. McCuistion, India Rubber World, 125, 575 (1952).

Tests of experimental designs and actual experience with working applications of the correct principles make it appear practical to use O-rings for a variety of rotating shaft seals.

Toroidal Sealing Rings. *India Rubber J.*, 122, 243 (1952).

A new British Standard for Dimensions of Toroidal Sealing Rings (BS 1806: 1951) has just been issued. It applies to the dimensions of toroidal sealing rings, sometimes referred to as O-rings, which are used as packings for reciprocating mechanisms and as gaskets for static purposes for light and medium general engineering applications. These sealing rings are not intended for use at pressures in excess of 1,500 p.s.i.

O-Ring. *Modern Plastics*, 29, 165 (1952).

One of the smallest molded polyethylene applications reported to date is an O-ring produced by Grebar, Inc., for use in military time fuses. Each ring weighs 0.0205-grams. Its inside diameter is 0.055-inch, and its outside diameter measures 0.179-inch. Its wall thickness measures 0.062-inch.

Army Ordnance Mechanical Rubber Goods. G. Reinsmith, I. Kahn. India Rubber World, 126, 219 (1952).

O-rings are among the mechanical rubber goods used by Army Ordnance.

Patents

Pistons, Packing. F. S. Cooke, British patent No. 406,493 (1934).

A packing ring for the piston in a sausage-filling machine is described.

Stuffing-Box Packing. R. F. Nowalk, J. W. Watson, British patent No. 428,006 (1935).

One or more rubber rings arranged between the flanges of a U-section leather ring are used for stuffing-box packing.

Piston Packings. Hydraulic Brake Co. British patent No. 430,209 (1935).

A circular piston packing for a hydraulic brake system is described.

Shaft Packings. Siemens-Schuckertwerke A.-G., British patent No. 492,954 (1938).

A rubber packing ring for rotary shafts is described.

Shaft Sealing Devices. British Thomson-Houston Co., Ltd., British patent No. 505,145 (1939).

A shaft seal is described in which the seal is normally open and is closed by the application of fluid pressure to a tubular or other member of rubber or other material. A rubber sealing ring is used to effect the seal.

Seals for Rotating Shafts. Thompson Products, Inc., British patent No. 512,965 (1939).

A rotating shaft seal ring of synthetic rubber is described.

Packing. N. A. Christensen. United States patent No. 2,180,795 (1939).

A rubber packing ring for use with a piston and cylinder is described.

Packing or Piston Rings. L. Newal and Airspeed, British patent No. 528,208 (1940).

A packing ring used to seal the oil cylinder of a hydraulic shock-absorber has one or more annular slits or cuts extending to one or more of the surfaces of the ring.

Pressure Seal. N. A. Christensen, U. S. patent No. 2,394,364 (1943).

A circular rubber packing ring is described.

Sealing Device. Julius Naab, Ingersoll-Rand Co., U. S. patent No. 2,456,529 (1945).

A sealing device includes a body with an annular groove, sealing means in the groove consisting of segments, and a rubber ring in the groove to urge the segments radially outwards.

Rotary O-Ring Seal for Roll-Necks. Shirrel A. Hastings, Crane Packing Co., U. S. patent No. 2,571,035 (1951).

A seal for roll-necks comprises an O-ring, a washer, and pins.

Piston Packing for High-Pressure Lubricating Pumps.

I. C. Martonfalvy, Uni-Gun Lubricating Equipment, Ltd., British patent No. 600,048 (1948).

A resilient circular synthetic rubber ring, flanked on each side by a flat faced ring, is used in the packing groove of a pump plunger in a lubricating pump.

Flexible Sealing Rings. T. A. Harris and J. Lucas, Ltd., British patent No. 654,509 (1951).

The invention proposes a method of molding in which the flashing is located about 45 degrees to the equatorial plane of the O-ring, instead of around the equatorial portion, where the usual method of manufacturing leaves a flash, which, although removed, may affect the functioning of the ring.

Packing Gasket and Seal for Use with Relatively Reciprocable Elements. J. S. Aber, British patent No. 654,801 (1951).

A packing groove in one of two relatively reciprocable elements, e.g., the rod passing through a cylinder end-wall, contains an O-ring and on either side of the O-ring a restraining ring.

Sealing Devices for Pistons. Société d'Inventions Aeronautiques & Mechaniques, French patent No. 928,101 (about 1948).

Two rubber rings of different hardness, one securing the extension of the other, are included in the sealing device.

Pressure Seal. N. A. Christensen, U. S. patent No. 2,467,370 (1949).

A universal coupling for a fluid pressure conduit utilizes packing rings.

Sealing Device. N. A. Christensen, U. S. patent No. 2,471,-933 (1949).

This patent covers the combination of a hollow member adapted to contain fluid under pressure, a member attached thereto and stationary therewith and having a recess opening outwardly therefrom, a packing element comprising a resilient ring in the recess, and a coupling member extending through this ring and having a threaded connection with the first-mentioned member.

Sealing and Packing Devices for Pistons and the Like. D. F. Denny, British patent No. 619,435 (1949).

Two packing rings, one with a Shore hardness of 50 to 55, and the other with a Shore hardness of 95 to 98, provide a sealing device for pistons, etc.

Piston Packing. Wingfoot Corp., British patent No. 623,397 (1949).

A packing includes a piston and a cylinder, in which an axially extending boss is provided on the piston. This boss has a cylindrical surface adjacent to the end of the piston. An O-ring engages the cylindrical surface of the boss, the piston shoulder, and the inner surface of the cylinder upon movement of the piston in one direction.

Packing Gasket and Static Seal. J. S. Aber, British patent No. 641,673 (1950).

An O-ring seated in the groove in a U-ring is used as a gasket or seal, e.g., to seal the passageway between a plunger and cylinder.

Sealing Device. N. A. Christensen, U. S. patent No. 2,509,-672 (1950).

A sealing device comprises a piston having an annular peripheral groove therein, a band and an endless ring of rubber-like resilient material seated within the groove.

Paley Report

(*Continued from page 73*)

vinyl-toluene as a substitute for some of the uses of styrene. Although not a complete substitute, it is satisfactory for replacement of a portion of the styrene in synthetic rubber, emulsion paints, and plastics. It is actually superior in some paints and varnishes.

Aromatics from Eight-Carbon Atoms

C_8 aromatics are produced by a catalytic reforming process similar to those for benzene and toluene. They include *o*-, *m*-, and *p*-xylenes and ethylbenzene. The mixtures are used for aviation gasoline components and solvents. Since 1946 *o*-xylene has been isolated for conversion to phthalic anhydride, and *p*-xylene is being separated for use in the new fiber, Dacron.

These compounds hold promise as chemical raw materials. Potential quantities available are much greater than foreseeable future requirements. Intensive work on separation techniques is in progress.

Polycyclic aromatics are present in small quantities in petroleum and can be produced from it. The entire United States production comes from coal tar. In England, the Catarole process has been put into operation to make naphthalene, methyl naphthalene, anthracene, and other aromatics. This method is not at present in use in the United States.

Naphthalene, the most important of the polycyclics, was produced from coal tar to the extent of 300 million pounds in 1950. Present demand is 450 million pounds and is being met by importing the difference. Although phthalic anhydride is a large naphthalene consumer and is sure to grow, it may be more advantageous to produce it by the petroleum *o*-xylene route than by producing naphthalene from petroleum.

Cresylic acids are recovered from heavy cracked petroleum distillates by alkaline extraction. They are present in amounts up to 2%. They consist of alkyl phenols, chiefly cresols and xylenols. More than two-thirds of 1950 production was from coal tar, and imports have supplied a large portion of United States demand in the past. Total production in 1950 was 67.7 million pounds, of which 16 million came from petroleum. Largest use is in phenolic-formaldehyde resins and tricresyl-phosphate plasticizers. No serious problem of supply exists here.

(*To be continued*)

Compounding Research

(*Continued from page 69*)

Symposium on Recent Developments in the Evaluation of Natural Rubber, on June 26, 1952. Abstract in India RUBBER WORLD, 126, 2, 239 (1952). A special bulletin containing this paper will be published in the near future by the American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

(23) "Temperature Measurements in the Mooney Viscometer." *ASTM Bulletin*, 176, 60 (1951).

(24) "Effects of Variations in Rotors on Mooney Viscosities." National Bureau of Standards Report 1101 to Synthetic Rubber Division, RFC, Washington, D. C. (1951).

(25) "A Procedure for Adjustment of Mooney Viscometer Die Closure." G. E. Decker. NBS Report to Synthetic Rubber Division, RFC, (Mar. 15, 1951).

(26) "Stress Analysis Utilization in Dynamic Testing." R. W. Brown, *Experimental Stress Analysis*, 4, 2, 49 (1947). (This is a yearly publication issued by Addison-Wesley Press, Kendall Square Building, Cambridge, Mass.)

(27) "Report on Effect of Plying up Compression Set Specimens When Making Compression Set Tests." A. E. Juve, F. C. Thorn, A. J. Kearfott, J. F. McWhorter, L. V. Cooper, *Am. Soc. Testing Materials, Proc.*, 47, 387 (1947).

(28) "Deformation Characteristics of Rubber and Rubber-Like Compounds—as a Measure of Quality, Especially in Control." L. V. Cooper, India RUBBER WORLD, 119, 2, 205 (1948).

(29) "The Importance of Controlling Heat Losses in Molding Operations." *Ibid.*, 121, 4, 413 (1950).

(30) *Rubber Age (N. Y.)*, 28, 6, 307 (1930).

(31) "Effect of Atmospheric Humidity on GR-S." *Ind. Eng. Chem.*, 37, 4, 378 (1945).

(32) "Effects of Humidity During Storage of Vulcanizates of GR-S and GR-S-10 on Their Elongations at Constant Stress." Report SP-T-215, Office of Rubber Reserve, RFC, (July 3, 1945).

(33) "Effect of Moisture on Curing Rate of GR-S." *Ind. Eng. Chem.*, 36, 8, 724 (1944).

(34) "Effect of Moisture on GR-S, Rate of Cure and Physical Properties." *Ibid.*, 38, 1, 58 (1946).

(35) "The Effect of Water on Processing and Cure of GR-S Tire Compounds." Report of B. F. Goodrich Co. to Office of Rubber Reserve (Jan. 9, 1943).

(*To be continued*)

Editorials

Educating the Rubber Industry

THE editor of an industry trade publication such as India RUBBER WORLD has as his primary duty the collection and dissemination of information on the technical, economic, and news aspects of his industry and associated industries. In this work he is often disturbed by the peculiar non-uniformity of the knowledge of many companies and individuals with whom he comes in contact, with regard not only to current technological and economic information, but, more particularly, the fact that, in many instances, they do not know how to go about getting some of this information.

In spite of the best efforts of the industry trade journals, the publications of the American Chemical Society's Rubber Division and other Divisions, the American Society for Testing Materials, and other scientific and engineering and professional organizations, many companies and individuals are too often inadequately informed as to the existence of procedures and techniques of great value to them in their business and professional life.

When this fact is pointed out to them, they usually take the position that they cannot afford the time and money to become completely informed on matters not directly involved in their day-to-day problems and add that only the large companies and the persons in top positions can manage to keep up to date on all of the latest developments. This statement, even if partially true, does not preclude the possibility that the situation should and could be improved. The surprising thing about it is that even the larger companies with their greater facilities are the most frequent users of even better information facilities, when available.

A recent memorandum issued by the library committee of the Division of Rubber Chemistry, A. C. S., points out the value of a central library to the larger companies when it states: "The largest and most comprehensive private libraries have made continuous use of the Division Library for the past three years."

The Rubber Manufacturers Association is at present carrying out an educational program throughout the country on quality and packaging specifications for crude natural rubber. The RMA contends that because many of the smaller firms lack adequate knowledge of quality, packing, and inspection procedures recommended by the RMA and the Rubber Trade Association of New York, these companies are paying millions of dollars more for their rubber than is warranted by the quality of the material delivered to them. This situation apparently came about because many companies in the industry were not adequately informed on these procedures, even though they have been in existence for at least 15 years.

Much information has been developed in the past ten years as a result of the government synthetic rubber program. Although much of this information, particularly that relating to research and development, has been published, there is and will continue to be much more that should be published, and the indexing and cataloguing of this material in its entirety has never accomplished.

Statistics on the rubber industry are developed by government agencies and the RMA. Statistics are available from both sources to varying degrees, but not always are they in complete agreement, nor do they have the same scope.

The first effort to provide a reasonably comprehensive central information bureau is found in the library of the Division of Rubber Chemistry, A. C. S., organized about three years ago. An article on this venture appeared in the February, 1952, issue of India RUBBER WORLD. In the above-mentioned more recent memorandum from the library committee it is pointed out that probably the best way to support the Library is by annual contributions from the RMA, the suppliers, and the Division. The major financial support of the Library at the present time is the RMA, since, because of the nature of its organization, the Rubber Division cannot guarantee long-term financial support.

Rubber industry growth in the past ten years and the prospects for continued growth during the next ten or more years would seem to indicate the necessity of an expansion of the services required by the industry, not only for its scientific and technical personnel, but also for its business and management groups. Closer cooperation between the trade association and the technical, economic, and statistical organizations is not only highly desirable, but may become essential for an industry of this size.

India RUBBER WORLD would like to suggest that the support of the Division Library by the RMA, the Division itself, the supplier companies, and individuals be continued and placed on a permanent and sustaining basis. We would also like to suggest that these organizations and individuals give consideration to expanding the scope of the Library to include services of statistical and economic nature and to interest themselves in the thorough and proper recording of the results of the government research on synthetic rubber during the past ten years.

This problem of educating *all* members of industry in the many fields of activity involved is one that should be solved by the industry itself, with government in a secondary or supplementary role.

R. G. Seaman

DEPARTMENT OF

PLASTICS TECHNOLOGY

The Properties and Applications of Polyethylene[1]

H. F. Robertson[2]

ALTHOUGH various unsaturated hydrocarbons, of more or less complex structure, were first polymerized many years ago, the simplest unsaturated hydrocarbon, ethylene, successfully resisted all efforts to convert it into useful solid polymers until early in 1933. Prior to this date only liquid materials of low molecular weight had been directly synthesized from this gas; while small amounts of solid hydrocarbons had been made by an indirect method from substituted hydrocarbons containing bromine or nitrogen (1).[3]

Rapid progress followed the discovery in 1933 (2) in the laboratories of Imperial Chemical Industries, Ltd., that solid polymers could be made directly from ethylene by subjecting the gas to sufficiently rigorous conditions of temperature and pressure. Some years later a process developed at the Tonawanda, N. Y., laboratories of Linde Air Products Co., resulted in the production there of development quantities of polyethylene resin having a relatively high molecular weight. Because of the urgent need of adequate supplies of the material for the war effort, production units were built by E. I. duPont de Nemours & Co., Inc., at Belle, W. Va., and by Carbide & Carbon Chemicals Co. at South Charleston, W. Va. The latter plant was designed on engineering data obtained as far as possible from the Tonawanda pilot-plant operations. Production started in 1943, and these plants succeeded in making substantial quantities of urgently needed resin for use in the construction of radar and other cables for high-frequency use.

Polyethylene is manufactured by subjecting ethylene to elevated temperatures and very high pressures in the presence of a suitable catalyst. Many engineering problems are involved in the design and maintenance of the equipment used. For example, the compressors and piping must operate safely and continuously under pulsating loads at extremely high pressures. The efficient and safe operation of such equipment requires a careful choice of materials of construction and proper machine design so that damaging stress concentrations are avoided. In addition to the problems imposed by the high pressures used, there are various others both mechanical and chemical in nature.

As in the case of most polymerization reactions, monomer purity is of great importance and has considerable influence both on the efficiency of the process as well as on the quality of the polymer made. The variables of pressure, temperature, and catalyst concentration have the same effect on the rate of reaction and the molecular weight of the polyethylene produced as they have on most other addition polymers. Higher temperatures give higher conversions and lower molecular weights. Conversely, lower temperatures give lower conversion rates and higher molecular weight resins. Higher pressures, like higher temperatures, give higher conversions, but, unlike higher temperatures, they result in higher rather than lower molecular weight resins. Catalyst concentration is somewhat similar in its effect as temperature, with higher concentrations giving higher conversions, but lower molecular weight resins.

Properties of Poyethylene

As is the case with all products of polymerization, the properties of polyethylene resins depend to a large extent on their average molecular weight, on the distribution of the higher and lower polymers that go to make up that average molecular weight, and the ratio of straight chain to branch chain material present. All these variables are more or less controllable in the polymerization step. Accordingly, in a discussion of the properties of polyethylene resins it is necessary to cover products having a relatively wide range of properties.

As might be anticipated from the fact that the polyethylene resins are paraffinic in nature, they are relatively inert chemically, have outstanding electrical properties because they are relatively non-polar, and are characterized by lack of odor or taste and by low toxicity. As also might be anticipated, such properties as tensile strength, stiffness, and abrasion resistance increase markedly with increasing average molecular weight.

Polyethylene resins are "crystalline" polymers with 55-73% of the methylene group being present in crystallites (3, 4). The amount of crystallinity present varies with molecular weight; the lower polymers in a similar series contain less, and the higher polymers more.

Brown has made X-ray diffraction studies on oriented and unoriented polyethylene films (5). Figure 1 is an electron micrograph made by him which shows that the crystallites are randomly oriented in unstretching polyethylene. Figure 2 shows the crystallites in a partially stretched film of polyethylene and indicates an area where the crystallites are no longer randomly oriented

[1] Presented before the Toronto Section, Society of Plastics Engineers, Inc., Toronto, Ont., Canada, Mar. 18, 1952.

[2] Development manager, thermoplastics department, Bakelite Co., Division of Union Carbide & Carbon Corp., New York, N. Y.

[3] Numbers in parentheses refer to bibliography at the end of the article.

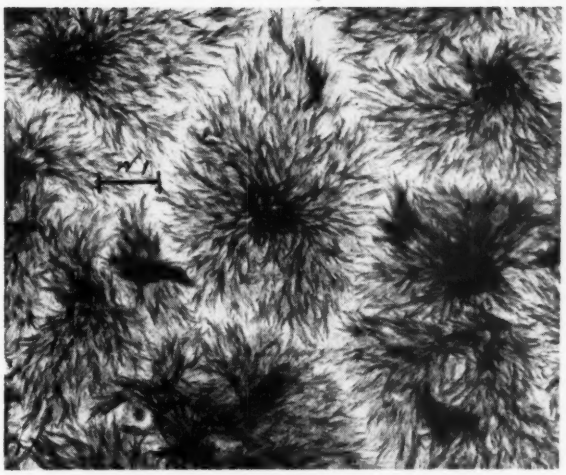

Fig. 1. Electron Micrograph of Unstretched Polyethylene Showing Random Orientation of Crystallites (5)

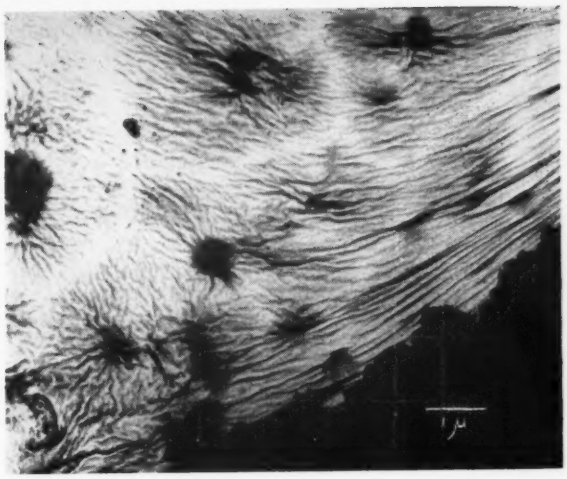

Fig. 2. Electron Micrograph of Partially Stretched Polyethylene Showing Orientation of Crystallites in the Stressed Region (5)

in the stressed region. The dark mass in the bottom right-hand corner is a dust particle which served a useful purpose. The film was so thin that it could not be stretched by the usual mechanical means so advantage was taken of the presence of the dust particle. When this was hit by the electron beam, it stretched the film the correct amount.

Table 1 lists the properties of polyethylene resins ranging in molecular weight from 1,000 to 38,000. As indicated previously, several of the physical properties, such as tensile strength, increase with increasing molecular weight.

TABLE 1. PROPERTIES OF POLYETHYLENE POLMERS

Designation	Mol. Wt.	Softening Temp., ° C.	Viscosity @ 130° C., Poises	Tensile, PSI.	Ultimate Elong., %	50% Brittle Temp. Index, °C (ASTM D746-447)
DXL 1	1000	37.5	0.4	...	...	...
DYDT	4000	93	5.2	...	...	...
Resin DYGT	7000	98	120	615	40	−16
DYJT	10000	100	$8x10^2$	...	...	...
DYLT	12000	104	$3x10^3$	910	100	−18
DXL 14	14000	104	$14x10^3$	...	...	...
16	16000	106	$50x10^3$	...	...	...
Resin DYNF	19000	108	$4x10^5$	1400	500	−55
DYNH	21000	110	$1x10^5$	1600	500	−75
DYNJ	23000	111	$1.5x10^6$	1800	500	−85
DXH 28	28000	112	$3x10^7$	2000	500	−100
34	34000	112	$1x10^8$	3000	625	below −105
38	38000	112	$3x10^8$	3000	625	below −105

Stress-Strain Properties

The mechanical properties of polyethylene, because they are involved in the performance of molded parts and extruded sections, are those of most interest. Figure 3 shows a typical low-magnification stress-strain curve for polyethylene. Although the literature and even the table of physical properties previously shown give the ultimate elongation of polyethylene (for the higher molecular weight resins) as 500 = 600%, such figures should be used with caution. Elongations of this order always include a large amount of cold drawing. The reported elongation values of 500% have led some to conclude that polyethylene is rubber-like or elastomeric in nature. It should not be so considered, but should be treated more like a metal amenable to cold drawing.

From the curve shown in Figure 3 it is apparent that permanent deformation of a part will take place if it is stressed at an elongation value much below the final elongation obtained at break. This consideration, however, is not the only one involved. Polyethylene parts will sometimes fail by cracking under relatively low stresses. This tendency depends to a great extent on the geometry of the piece, its environment, and the nature of the stress involved. The geometry of the piece is affected by scratches, holes, or other discontinuities which concentrate the stress in the sample.

Various liquids, such as alcohols, wetting agents, etc., are environmental factors influencing stress-cracking; while biaxial stresses appear to have considerably greater influence on this property than do monoaxial stresses (6). Carey, Schultz, and Dienes have studied this problem (7). They report that polyethylene pieces cannot be safely strained above about 7-8% when certain liquids or when mechanical nicking or scoring is present. Under certain conditions, when such factors are not present, strains as high as 40% may be tolerated. Such properties do not constitute a serious limitation in the use of polyethylene, but should be taken into consideration when any item involving this product is being designed so that satisfactory performance will be obtained. Other high-modulus plastics such as polystyrene, the rigid vinyls, and methyl methacrylate show this same stress cracking tendency, which has been compared by Carey to the stress-corrosion cracking obtained with metals in mildly corroding environments.

Some idea of the relative magnitude of the changes in breaking strength of injection molded polyethylene pieces may be seen in Table 2, which gives data reported by Carey (8).

TABLE 2. TENSILE BREAKING STRAIN OF INJECTION MOLDED POLYETHYLENE IN VARIOUS ENVIRONMENTS

(Nominal Values Over a Two-Inch Gage Length with 1/16-Inch Hole)
In Percentage

Sample	Air	Distilled Water	Soapy Water	Ethyl Alcohol	n-Amyl Alcohol	t-Amyl Alcohol	Toluene
1	51	60	51	18	6	7	14
2	62	54	41	38	15	13	18
3	39	42	46	36	20	20	14
4	45	45	51	44	25	20	21
5	42	44	44	40	29	26	20
6	48	47	47	44	36	38	38

Weathering Properties

Some studies have been made on the weathering properties of pigmented and unpigmented polyethylene formulations. One of the first changes noted on outdoor exposure is an increase in power factor. Figure 4 shows some curves recording data obtained by Maibauer and Myers (9) on Florida weathering of polyethylene.

It will be seen that after six months' exposure a brown compound shows very little change in power

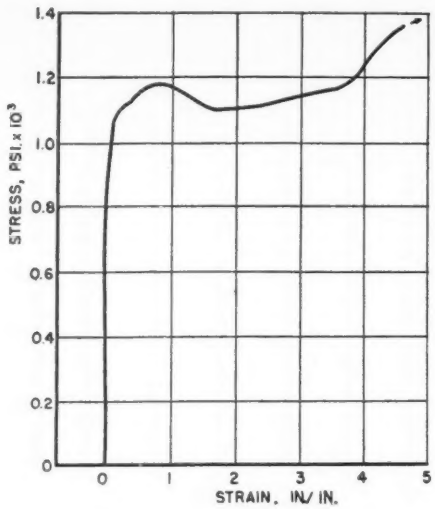

Fig. 3. Stress-Strain Curve for Molded Polyethylene

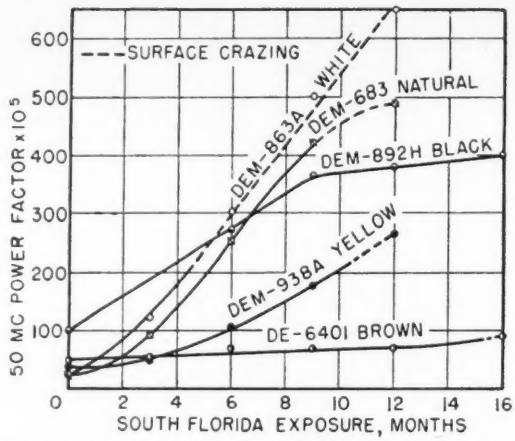

Fig. 4. Effect of Weathering on Physical and Electrical Properties of Polyethylene (9)

factor while surface crazing just begins to appear after 15 months. A considerably more rapid increase in power factor and the development of surface crazing appear in a white pigmented formulation as well as in an unpigmented compound. It is of interest that observations have been continued on the DEM-892H Black and the DE-6401 Brown since these data were first published. At the present time after 46 months' exposure the power factor on the black compound is 0.00435 with no change in surface appearance, and the power factor of the brown compound is 0.00207 with the surface of the sample showing very shallow crazing. The power factor of the black material has remained essentially constant since reaching the value found after eight months' exposure.

Melt Viscosity

Another physical property of polyethylene which may be of interest is the melt viscosity. In hot-melt applications which involve the spreading of molten polyethylene or polyethylene-paraffin wax mixtures on paper, low-melt viscosities are desirable. Polyethylene resins are substantially insoluble in all solvents at room temperature. Their solubility, however, rises rapidly with increasing temperatures, and solutions of adequately high solids content for various coating uses can be prepared at elevated temperatures. As the resins precipitate from solution upon cooling, the solvents must be removed in the drying operation at a temperature above the precipitation point. Because of this difficulty, solutions are not used, and it seems preferable to employ hot melts even if somewhat higher coating temperatures are required.

Liquid Absorption

Although polyethylene is substantially insoluble in all solvents at room temperature, it has a relatively high absorption for and permeability to a large number of fluids. In general, both absorption and permeability are a function of the polarity and molecular size of the liquid in contact with the polyethylene. Parliman (10) has determined the permeability of polyethylene to a large number of liquids. Because of the increasing use of polyethylene films and molded containers for packaging applications, such data are of utmost importance in determining whether or not the material can be used satisfactorily.

The absorption of various liquids by polyethylene appears to vary between wide limits, depending on the nature of the liquid held in contact with the resin. Table 3 shows the swelling indices of a representative number of liquids.

TABLE 3. SWELLING OF POLYETHYLENE RESIN (MOL. WT. 21,000) IN LIQUIDS

Test Liquid	Swelling Index at 60° C. (% Volume Change of Resin at Equilibrium)
Methanol	Negligible
Water	Negligible
Lactic acid	0.015
Propylene glycol	0.13
Linseed oil	0.45
Castor oil	0.65
Ethylene glycol monoethyl ether	0.95
Tricresyl phosphate	1.3
Di-2-ethyl hexyl phthalate	4.5
Methyl ethyl ketone	6.4
Mineral oil*	8.7
Silicone liquid†	9.5
Xylene	19.5
Chloroform	21.0
Benzene	23.0
Dichlorobenzene	26
Tetrahydronaphthalene	36

*Socony No. 309.
†Type 500, viscosity 0.65 cstk., 25° C.

It will be seen that polyethylene is very selective in its absorption characteristics, with the swelling indices varying between a negligible value for water and liquids which contain a relatively large amount of oxygen, to much higher values for hydrocarbons and other liquids deficient or lacking in oxygen.

Gas Permeability of Films

Because of the wide and increasing use of polyethylene film in packaging, some data on the gas permeability may be of interest. Table 4 illustrates some of the measurements made at the laboratories of Linde Air Products.

TABLE 4. PERMEABILITY OF FILMS

Film	Oxygen,* Cc./Sq. In./24 Hrs.	Water Vapor† G./Sq. In./24 Hrs.	Carbon Dioxide‡, Cc./Sq. In./24 Hrs.
Rubber hydrochloride	0.4	0.0190	9.3
Regenerated cellulose (450 MSAT)	0.1	0.0290	less than 0.5
Polyethylene			
0.001-inch thick	2.1	0.0050	26.0
0.002-inch thick	1.1	0.0041	10.2

*Determined at 75° F. and 75% relative humidity.
†Determined at 95° F. with dry air on one side and saturated air on the other side.
‡Determined at 75° F. and 0% relative humidity.

It will be seen from this table that polyethylene film has a comparatively low water-vapor permeability and a comparatively high oxygen and carbon dioxide perme-

ability. Other tests made at the same laboratory (11), using a novel method of oxygen permeability which involves the change in color of the filament of a tungsten lamp bulb in the presence of small amounts of oxygen, are shown in Table 5.

TABLE 5. PERMEABILITY OF FILMS TO OXYGEN

Film	Thickness, In.	O_2 Permeability* Cc./Sq. In./24 Hrs.
Vinyl chloride	0.0010	0.19
Polyethylene	0.0010	2.60
Rubber hydrochloride	0.0012	0.55
Regenerated cellulose	0.0010	0.09
Rubber hydrochloride—regenerated cellulose laminate	0.0032	0.0002
Polyethylene—regenerated cellulose laminate	0.0030	0.0002

*Determined at 77° F. and 60% relative humidity.

The high oxygen and carbon dioxide permeability characteristic of polyethylene film has considerable practical application in the wrapping of fresh vegetables. Vegetables continue to absorb oxygen and give off carbon dioxide after being harvested. Where oxygen is not available from the atmosphere, it is obtained by the decomposition of the vegetable itself, with resultant spoilage. Accordingly, any film which will allow the transmission of adequate amounts of oxygen in one direction, the elimination of built-up carbon dioxide in the other direction, and, which at the same time will prevent the vegetables from drying out will result in much greater package life. For some vegetables, however, the gas permeability of polyethylene is still not sufficiently high, and perforation of the package is recommended in order to improve the keeping qualities of the vegetable. This is particularly true with those having a relatively high respiration rate and for vegetables stored at ordinary temperatures.

Fabrication of Polyethylene

Polyethylene resins are capable of being fabricated by compression and injection molding, extrusion, calendering, and various coatings methods including flame spraying, spreading of hot melts, and solution casting.

Extrusion

The most important fabricating method, from the point of view of being the largest consumer of polyethylene, is extrusion. Extrusion equipment is used for the production of insulated wire and cable, for the coating of paper by laminating a flat extruded film with paper, and for the production of unsupported film by the extrusion and subsequent drawing down of flat sheet or tubing.

The extruder used in the production of flat film for lamination to paper is a conventional piece of equipment. Polyethylene is fed into the hopper and is softened by heat applied to the cylinder, and by the frictional heat generated in passing the material through the cylinder. In the case of coated paper, resin with a molecular weight around 21,000 is generally used.

As has previously been indicated, polyethylene has a relatively sharp melting point. At temperatures just above this melting point, however, the material under shearing stresses has an elastic as well as a viscous component. This elastic component gives "nervy" compounds that are difficult to extrude. Accordingly, temperatures considerably above the melting point are used in extruding polyethylene in order to eliminate, insofar as possible, the elastic component. The compound temperatures usually employed are of the order of 200° C. Temperature measurements made on a typical extruder are shown in Table 6.

TABLE 6. EXTRUSION TEMPERATURES FOR POLYETHYLENE

	Temperature, °C.
Cylinder Hopper	20
Back	100
Middle	175
Front	220
Head	240
Die	250
Screw coolant	40-85
Compound temperature	220-220

Figure 5 shows the effect of extruder screw speed and temperature on the output rate.

Injection Molding

Polyethylene is also successfully used in conventional injection molding machines. As in the case of extrusion, adequately high compound temperatures are desirable and should be of the order of 200° C. or higher. Polyethylene has a relatively high shrinkage compared to other plastic materials, and due allowance should be made for this fact in designing molds. A shrinkage of 2.5-3.5% is normally encountered for DYNH grade of resin. This varies to some extent with mold and cylinder temperature and the plunger pressure used. The use of warm molds favors improved gloss. Molding pressures depend to some extent on the size and the shape of the casting and are generally below 10,000 psi. at cylinder temperatures of 175-260° C.

Calendering

Although the great bulk of film made is produced by extrusion, some polyethylene film or sheeting is prepared by calendering operations. Standard calenders can be used for this purpose.

Applications of Polyethylene

The original and still the most important application for polyethylene is the wire and cable field. Here its good electrical properties, moisture resistance, and lightness make polyethylene of interest both as a primary dielectric for high-frequency applications, and as a jacketing material for power and communication cables. One of the most publicized of such applications is its use as a jacket on Alpeth cable, where it replaces lead. Polyethylene is currently being used in very substantial quantities in

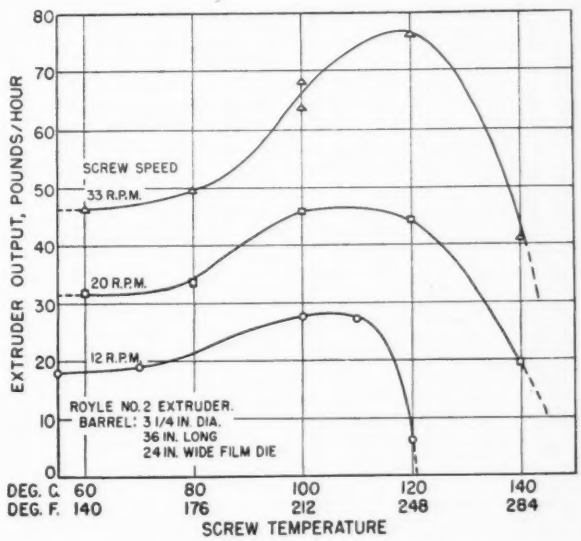

Fig. 5. Effect of Extruder Screw Speed and Temperature on Output Rate

several wire and cable applications involved in the defense effort. It is found almost universally in all television installations as the dielectric in 300-ohm twin-lead wire.

Polyethylene film has shown tremendous growth in the packaging field. Mention has been made of this use in wrapping vegetables. It has been used, however, for wrapping many more products. It is particularly useful for wrapping those materials which rapidly deteriorate the usual cellulosic wrapping materials. The wrapping of peat moss and fish bait is an example. Rose plants have been found to survive much longer when wrapped in polyethylene film. Because of its good low temperatures, it is also widely used for refrigerator bags and for wrapping various meat products.

One of the more recent applications involves the construction of large balloons designed to travel to the stratosphere. Here again, the low-temperature properties of polyethylene allow it successfully to go through a critical low-temperature zone which tends to destroy other films by cracking.

Polyethylene can be extruded into monofilaments and then cold oriented to give filaments of high tensile strength. These can be subsequently woven on ordinary fabric looms to give materials which are of use as automobile seat covers. Innumerable items are now molded from the material. Possibly the most important are the squeeze bottles that are fabricated either by blowing or injection molding.

Although polyethylene has only been available for civilian use since the close of World War II, a large number of applications has been worked out in this relatively short time. The number of applications continues to grow almost geometrically, so that it has been difficult for supply to catch up with demand. It is anticipated that this situation will correct itself shortly as new production comes in so that polyethylene can continue its rapid growth as one of the most important plastic materials available today.

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Meetings and Reports

Symposia Features of Plastics Division Meeting

THE Division of Paint, Varnish & Plasties Chemistry of the American Chemcal Society met in conjunction with 18 other A. C. S. divisions at the Society's one hundred and twenty second meeting in Atlantic City, N. J., on September 15-19. Total registration at the meeting was approximately 8,750, and attendance at the Plastics Division sessions ranged between 250-300 persons. Plastics papers were presented at the Division's September 15 morning session and at morning and afternoon sessions on September 17 and 18. The other Division sessions were devoted to general papers on paint and varnish, a symposium on emulsion polymers and emulsion paints, general papers on printing inks, and a symposium on resins in textile finishes.

Symposium on Plastics Literature

A symposium on the literature of synthetic resins and plastics was held on Monday morning, September 15, at Convention Hall. The symposium consisted of six papers and an introduction by the presiding officer, Gordon M. Kline, National Bureau of Standards, and was presented jointly by the Plastics Division and the Division of Chemical Literature. The following papers were read:

"Basic Science." Herman F. Mark, Polytechnic Institute of Brooklyn. This paper discussed sources of information on the fundamentals of polymer science, including the chemistry of polymerization, molecular structure of high polymers, physical chemistry of plastic behavior, and the relations between polymer structure and properties.

"Know-How for Plastics Engineering." M. H. Nickerson and K. T. Barker, DeBell & Richardson, Inc. Chemical engineering in the plastics field follows the same fundamental principles that apply to any other field. Since the field is so fast moving, alertness is required to follow the advances described in publications. The various literature sources were reviewed, and a typical example was given of fact finding for a vinyl chloride plant.

"Mechanical Engineering, Fabricating Methods, and Machinery." H. W. Wehr, Jr., and G. B. Thayer, Dow Chemical Co. Searching the mechanical engineering literature for information on fabricating methods and machinery should include consideration of patents, periodicals, manufacturers' technical data, institutional publications, textbooks, proceedings of professional societies, bibliographies, unpublished data, foreign literature, dissertations, and abstracts. A bibliography of source material was given, together with suggestions for obtaining some types of information not readily available.

"Properties and Applications of Modern Plastics." Thomas Hazen and A. J. Weith, Bakelite Co., Division of Union Carbide & Carbon Corp. The specialized forms, properties, and uses of various types of plastics were reviewed with the aid of charts, illustrations, and samples of products.

"Test Methods and Standards." Dr. Kline. Sources of information on testing procedures were reviewed. The paper covered both methods in process of development, and standard methods of various organizations and countries. Specification literature both here and abroad were discussed in detail.

"Plastics Literature in Government Reports." James Kanegis, Office of Technical Services, and Irvin Wolock, NBS. Government reports are a valuable source of literature on plastics. Since the government bureaus to be contacted depend on the type of information desired, the publications and subjects of the various bureaus were described.

Papers on Plastics Extrusion

A series of eight papers dealing with the theory and operation of plastics extruders was presented at the morning session on Wednesday, September 17. A. K. Doolittle, Carbide & Carbon Chemical Corp., presided over the session, held at Haddon Hall Hotel. The following papers were presented:

"Introductory Remarks on Plastics Extrusion." W. L. Gore, E. I. du Pont de Nemours & Co., Inc. The basic principles of the extrusion process are little known, and there is a wide diversity of opinion on the design and operation of extruders. The following papers outline the fundamental theory of plastics extrusion, as far as it is now known, and show how it is used in design.

"Survey of Basic Concepts on Extrusion." R. A. Strub and J. F. Carley, du Pont. The differential equation and its solution for the two-dimensional flow of melts in extruders were given in this paper. The influence of a variable viscosity across the thread depth was discussed, and laws of similitude were offered for extruders with and without heat exchange to the surroundings. A general relation for the power absorbed in screws with rectangular profiles was proposed.

"Application of Theory to Design of

Extruders." Carley and Strub. A procedure for near optimum design of melt extruders was derived, based on the theories of flow and power consumption developed in the preceding papers and on a power balance. The method was applied to the design of a melt extruder for polyethylene terephthalate.

"Power Requirements for Melt Extruders." R. S. Mallouk and J. M. McKelvey, du Pont. The exact calculation of power requirements for the extrusion of non-Newtonian plastic melts is possible only if the temperature gradients in the extruder are known. In addition, rheological data for the particular plastic must be available. Using an "effective" viscosity, however, it is possible to make approximate calculations.

"A Simplified Flow Theory for Screw Extruders." Carley, Mallouk, and McKelvey. On the basis of simplifying assumptions, a useful flow equation can be derived for Newtonian liquids in a screw extruder. This equation is used to design an extruder screw to give maximum output in a given machine.

"Extruder Scale-up Theory and Experiments." Carley and McKelvey. The theory of melt extruders is extended to adiabatic melt extruders whose channel dimensions may vary along the screw. Rules appear for the prediction of the performance of large extruders from data taken on small-scale models. It seems reasonable that these rules may also be applied to plasticizing extruders.

"Experimental Studies of Melt Extrusion." J. M. McKelvey. Experimental studies have shown that the theoretical flow equations describe the behavior of viscous Newtonian liquids in the screw extruder. Similar studies with molten polyethylene terephthalate have also given correlation between theory and observed data.

"Future Extrusion Studies." C. H. Jepson, du Pont. A summary of the results of the theoretical and experimental work of the preceding papers was made, showing the practical importance of this information in the design of extruders. Heat transfer and other unsolved problems are discussed, together with possible methods of solution. It is suggested that extruder capacity could be greatly increased if design were to take advantage of the mechanical work input in heating the polymer.

General Plastics Papers

The Wednesday afternoon session, with Mr. Doolittle again presiding, comprised the following three general papers on plastics:

"Rheology of Lubricated Polytetrafluoroethylene Compositions." E. E. Lewis and C. M. Winchester, du Pont. The flow mechanism of lubricated polytetrafluoroethylene compositions has been examined and appears to be a combination of permanent and elastic deformation in the region just before the orifice. Significant improvements in flow can be made by streamlining the orifice approach.

"Epoxy Fatty Acid Esters—A New Class of Vinyl Plasticizers." F. P. Greenspan and R. J. Gall, Buffalo Electro-Chemical Co., Inc. Epoxy fatty acid esters constitute a new class of vinyl plasticizers characterized by good overall plasticizing performance combined with unique inherent stabilizing properties. The preparation of typical esters is discussed, and performance data are shown on modulus, tensile, elongation, hardness, and low-temperature flexibility.

"Determination of Gel Times of Multifunctional Reactants." R. E. Burnett, General Electric Co. The phenomenon of gelation can be used to advantage in evaluating cross-linking polymerizations. Use of the gel-time meter permits rapid and accurate determination of gelation.

Symposium on Adhesives

Nine papers were presented at morning and afternoon sessions on Thursday, September 18, in a symposium on adhesives. C. F. Brown, Bethany College, presided over these sessions and made the introductory remarks. Papers presented follow:

"A Market Survey of Adhesives." J. R. Skeen and M. V. Donnelly, Foster D. Snell, Inc. The recent developments in adhesives were discussed with special reference to raw materials, applications, and the amounts involved.

"Theories of Adhesion." F. W. Reinhart, NBS. Adhesion theories were considered, and it is shown that the strength of any particular adhesive system depends on the nature of the adhesive and the adherend, the surface characteristics, and physical properties of the components, and the design of the joint.

"Solution Type Adhesives." S. E. Urban, B. B. Chemical Co. The general compositions, methods of application, and uses of a variety of solution type adhesives were covered.

"Solvent Retention of Adhesives." A. B. Crowell, Union Paste Co. The drying rate of a solvent-type adhesive is related to the solvent retention of the adhesive. Data were presented on a variety of solvents and their retention in vegetable, animal, natural and synthetic rubber, and polyvinyl acetate types of adhesives.

"Pressure-Sensitive Tape Adhesives." W. E. Lundquist, R. D. MacDonald, and H. J. Tierney, Minnesota Mining & Mfg. Co. Pressure-sensitive tape adhesives require two factors: (1) a degree of permanent aggressive tackiness at room temperature to provide firm bonding upon mere contact; and (2) a degree of cohesion to permit unwinding the tape wouthout splitting or offsetting the adhesive, or leaving a residue. The adhesives are based on natural and synthetic rubbers, and synthetic resins, and more than 200 varieties of pressure-sensitive tapes are now marketed commercially. Properties and applications of various tapes were considered.

"Adhesives Based on Aqueous Dispersions of Elastomers." C. R. Peaker, Naugatuck Chemical Division, United States Rubber Co. The various aqueous dispersions of elastomers are roughly classified into groups which include *Hevea* rubber and derivatives, butadiene copolymers, chloroprene polymers, vinyl copolymers, isobutylene polymers, and reclaimed rubbers. The preparation of adhesives was discussed, together with the functions of various additives, and properties and methods of application were described.

"Amino Resin Adhesives." G. S. Casebolt, American Cyanamid Co. A discussion was given of the chemical structure and cure mechanism of urea-formaldehyde and melamine-formaldehyde resins used for adhesive purposes. Large-scale applications include wood adhesion, foundry core binding, and paper gluing.

"Liquid Starch Adhesives." R. E. Smith, H. B. Fuller Co. Modern industrial starch and starch derivative adhesives were discussed. Descriptions were offered of raw materials, compounding ingredients, modifying agents, properties, and uses.

"Mechanical Testing of Structural Adhesives." H. Grinsfelder, B. Coe, and R. P. Hopkins, Rohm & Haas Co. Mechanical testing of adhesives requires an understanding of the effects of different types of stresses and specimen constructions on the apparent strength of an adhesive. After these variables are considered, it is generally desirable to select tests which employ a simple specimen and fail the adhesive.

SPI Plastic Pipe Research Program

A PLASTIC pipe research project has been undertaken by The Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36, N. Y., at the National Sanitation Foundation of the University of Michigan. The project will determine the performance characteristics of plastic pipe in the transmission of water in rural supply systems. Plastic materials currently being tested by the Foundation include polyethylene, polystyrene, cellulose acetate butyrate, and polyvinyl chloride copolymers, and additional plastic materials being used in the manufacture of pipe will also be tested.

The main objectives of the program are proof of non-toxicity and the fact that plastics do not impart odor or taste to water. Quarterly progress reports on the test findings will be issued for the information of the participating companies. At the conclusion of the project, which will take about two years, a comprehensive report will be disseminated to all public health officials, colleges, and universities throughout the country.

SPI members participating in this project are: American Hard Rubber Co.; Anesite Co.; Bakelite Co.; Carlon Products Corp.; Clopay Corp.; Crescent Plastics, Inc.; Dow Chemical Co.; E. I. du Pont de Nemours & Co., Inc.; Firestone Plastics Co.; Gering Products, Inc.; Golden Bear Mfg. Co.; B. F. Goodrich Chemical Co.; Goodyear Tire & Rubber Co.; Industrial Synthetics Corp.; Johnson Plastic Corp.; Koppers Co., Inc.; Elmer E. Mills Corp.; Monsanto Chemical Co.; United States Rubber Co.; Plastex Corp.; Tennessee Eastman Co.; and Yardley Plastics Co.

SPE Sections Meet

New York Business Meeting

THE New York Section, Society of Plastics Engineer, began the new season with its annual business meeting and "gripe session" on September 17 at the Gotham Hotel, New York, N. Y. Some 45 members and guests attended the meeting, which included a cocktail hour and dinner, followed by a showing of the Bakelite Co. film, "Flight to the Future." President Bruno E. Wessinger, Wess Plastic Molds, Inc., presided over the business session, which included a discussion of the educational program aimed at the establishment of a plastics vocational high school; a discussion of future meeting programs; and the appointment of Saul Blitz, Noma Electric Co., to head arrangements for the annual Christmas party. Table favors

(*Continued on page* 142)

Scientific and Technical Activities

Many Special Features for Rubber Division, A. C. S., Buffalo Meeting

THE fall meeting of the Division of Rubber Chemistry of the American Chemical Society held separate from that of the parent Society, will take place in Buffalo, N. Y., at the Hotel Statler, October 29, 30, 31. Waldo L. Semon, B. F. Goodrich Co., chairman of the Division, will preside. The Buffalo Rubber Group is acting as host, and the general chairman of the local committee on arrangements is John G. Augenstein, U. S. Rubber Reclaiming Co.

There will be many special features at this meeting, such as the Goodyear Medal Award Lecture by H. E. Simmons, former president of the University of Akron; plant trips through various industries in the Buffalo area; the suppliers' cocktail party; announcement of new officers for 1953; and entertainment for the wives and lady guests of the members. The Division banquet on the evening of October 30 will include the presentation of the Goodyear Medal to Dr. Simmons and will be concluded with an entertainment program.

Other members of the local committee on arrangements, in addition to Mr. Augenstein, are: Paul Sick, Hewitt-Robins, Inc., meeting rooms, equipment, etc.; Charles Miserantino, Dunlop Tire & Rubber Corp., registration; Russell Schutz, U. S. Rubber Reclaiming, housing and information; William Sauter, E. I. du Pont de Nemours & Co., Inc., and E. C. Siverson, Buffalo Weaving & Belting Co., plant visits and transportation; Donald Bradley, Commercial Chemicals Co., banquet and entertainment; Charles Smith, U. S. Rubber Reclaiming, finances; and Mrs. C. H. Petersen and Mrs. R. Cowen, ladies' entertainment.

The 25-Year Club luncheon meeting at the Hotel Statler on Wednesday noon, October 29, will be presided over by H. F. VanValkenburgh, Dunlop Tire, chairman for this event.

Arrangements for the suppliers' cocktail party on Thursday, October 30, preceding the Division banquet, are in charge of Jean Nesbit, U. S. Rubber Reclaiming.

The papers to be presented at the technical sessions, which begin on the afternoon of October 29 and continue through the afternoon of October 31, are given below.

WEDNESDAY AFTERNOON—OCTOBER 29
Hotel Statler

2:00 p.m.—1. **Introductory Remarks. Waldo L. Semon.**

2:10 p.m.—2. **A Study of GR-S Synthetic Rubbers Extended with Rosin-Type Acids. L. H. Howland,**[1] J. A. Reynolds, R. L. Provost. Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.

A study of copolymerization of butadiene with styrene in the presence of large amounts of emulsifier led to an investigation of the rubber properties of polymers extended with corresponding emulsifier acids in a manner similar to that reported for the extension of GR-S type polymers with petroleum oils. This included the investigation of synthetic rubbers extended with rosin and rosin derivatives. These materials have been found equivalent to the petroleum oils in extending efficiency, but are considerably superior in many other respects. In laboratory tests on tire tread and carcass vulcanizates from butadiene-styrene copolymers extended with rosin-type materials, substantial improvements were found in room temperature and hot tensile strength, abrasion resistance, and resistance to cut growth and heat build-up. Preliminary service tests have confirmed many of the improvements obtained in the laboratory.

2:25 p.m.—3. **The Effect of Chemical Composition of Petroleum Processing Oils on the Physical Properties of Oil Enriched Rubbers. K. V. Weinstock,** General Tire & Rubber Co., Akron, O.; R. B. Story, Polymer Corp., Sarnia, Ont., Canada; and J. S. Sheely, Sun Oil Co., Norwood, Pa.

A series of petroleum oils has been evaluated as plasticizers for high Mooney viscosity GR-S polymers. The oils selected cover the range of chemical composition usually found in rubber processing oils and varied in aniline point from a low of 29 for the relatively aromatic oil to a high of 222 for the relatively paraffinic oil. Chemical composition and physical properties have been obtained on these oils. The two molecular weight levels of the oils studied show that there is a minimum molecular weight necessary to obtain the best overall balance of properties from an oil-enriched rubber. All the oils examined were compatible with the high Mooney viscosity GR-S in loadings up to 100 parts of oil per 100 parts of rubber.

The effect of chemical composition of the oil on the stress-strain properties of the vulcanizates is small. The aromatic oils show slightly better tear resistance, higher elongation, and flex crack resistance. The paraffinic oils have better color, higher resilience, and improved low-temperature properties.

No outstanding differences were noted in the mixing, extrusion, or fabrication of the compounds prepared with the various oils. The stocks were mixed on the same Banbury cycle and extruded through the same die.

Test tires built from the special oil-enriched rubbers have been tested using commercial oil-enriched rubbers as controls.

2:50 p.m.—4 **Effect of Various Oils in the Oil-GR-S Masterbatch on the Breakdown of the Polymer.**[2] W. K. Taft, **June Duke**, A. D. Snyder, M. Feldon, R. W. Laundrie, Government Laboratories, University of Akron, Akron, O.

The development in the rubber industry whereby high-viscosity GR-S is masterbatched with oils has led to the investigation of various kinds of oils from several sources. The literature has many references to the effect of some of these oils on the properties of the cured rubber stocks, but only casual reference is made to the effect of the oil on the molecular size of the polymer.

High-viscosity, cold GR-S polymerized to contain gel or to be gel free was masterbatched with various commercial oils. Heat or Banbury treatment of the masterbatches has shown that the effect of the oils on the solubilizing of the gel and the breakdown of the benzene-soluble fraction of the polymers can be very different. The Mooney viscosity of the polymer also is affected differently by the several oils. Data presented appear to indicate that the method of processing of the stock in the factory may have to be adjusted for the type of oil used in masterbatching the polymer.

Fractions, as defined by the Rostler method of analysis, of several oils were prepared and tested. The results indicate that such fractions of the several oils tested all differ in their effect on the rate of change in polymer breakdown, condensation, or Mooney viscosity when the masterbatched polymer is subjected to heat or Banbury treatment. No correlation was found between the effects noted and the gravity, viscosity, viscosity index, or bromine number of the oils. Loss of oil due to high volatility can be predicted by low viscosities of the oil.

3:10 p.m.—5. **The Processing of Oil-Extended and LTP GR-S Black Masterbatch. H. L. Ericson** and L. D. Carver, Witco Chemical-Continental Carbon Co., Amarillo, Tex.

During the past few years considerable work has been presented on the technical aspects of the manufacture of low-temperature GR-S and HAF black GR-S masterbatch. With the more recent discovery of the oil-extended GR-S polymers by the General Tire & Rubber Co. research division, renewed interest has been shown in this work, but most of the papers published to date have dealt mainly with raw polymer studies, the carbon gel complex, and some tire test results. The effects of compounding and processing variables, particularly on the oil-extended polymers, have been investigated, but little data have been published.

This report is concerned with the results obtained from a laboratory investigation of the effects of compounding and processing variables on HAF black low-temperature GR-S masterbatch and two oil-extended low-temperature polymers, GR-S X-628 and GR-S X-629. The latter two polymers contain 25 parts processing oil per 100 parts LTP GR-S, and the GR-S X-629 also contains 50 parts of HAF black in addition to the 25 parts processing oil which is incorporated during manufacture. The results of this study indicate that numerous factors in compounding and processing affect quality and performance of the black LTP GR-S tread stocks.

Using base formulations and procedures with Size "B" laboratory Banbury mixing, the effects of Banbury cooling water temperatures, stock discharge temperatures, rotor speeds, milling cycles, remilling, and extrusion were investigated. Particular attention is given to the effects of these variables on the physical properties of the compounds, laboratory angle abrasion losses, flex cracking, and processing charactertistics. Several tables

[1]Names in bold face are those of the authors presenting the papers at the meeting.

[2]This work was carried out under the sponsorship of the Office of Synthetic Rubber, Reconstruction Finance Corp., in connection with the government synthetic rubber program.

and graphs are shown to illustrate these variables.

3:35 p.m.—6. **Preparation, Properties, and Evaluation of Diazo-Initiated Polymers. J. M. Wills,** Glen Alliger, B. L. Johnson, W. M. Otto, Firestone Tire & Rubber Co., Akron.

A diazo-initiated system of polymerization has been developed at 122° F., using a stabilized salt of diazotized p-nitroaniline, Nitrazole CF,[3] as initiator. Tire tests of 70/30 BD/ST polymer have shown tread wear approximating 41° F. cold rubber. Laboratory tread stock physical properties are equal to those of the 41° F. polymer and superior to those of GR-S. Present results indicate that a polymer equivalent to cold rubber for tread use can be produced at 122° F. Factory experience with 122° F. Nitrazole CF polymers (BD/ST) indicated an instability during high temperature processing. Santovar O[4] was found to repress gel formation and give better all-around processing.

The improved properties of the Nitrazole CF rubber appear to be the result of increased linearity and less cross-linking in the polymer chain together with an improved molecular weight distribution. This macrostructural change has been shown by a study of the relation between intrinsic viscosity and osmotic molecular weight and by fractionation of the polymer. This instance is believed to be the first in the study of synthetic emulsion polymers where it has been shown that a change in the polymerization initiator has led to a structural change in the product.

Butadiene/styrene copolymers made in the Nitrazole CF system at 41° F. with long reaction times (80 hours, approximating) show very high tensile strengths. This condition is consistent with their X-ray diffraction patterns which show ordering. Other properties are equal to or poorer than those of the 122° F. Nitrazole polymer, possibly as a result of the long reaction times.

3:55 p.m.—7. **Nonionic, Anionic, and Cationic Emulsifiers in Butadiene-Styrene Copolymerizations.**[5] A. F. Helin and J. M. Gyenge, University of Akron Government Laboratories; **D. A. Beadell,** General Aniline & Film Corp., New York, N. Y.; J. H. Boyd, Consultant, New York; R. L. Mayhew and R. C. Hyatt, General Aniline & Film Corp., Easton, Pa.

The type and the concentration of the emulsifying agents used in the preparation of synthetic elastomers by the emulsion polymerization technique are important factors in determining polymerization rates, latex stabilities, and polymer properties. The objective of the present program was to correlate by a systematic study, if possible, the above effects with the chemical structure and solubility characteristics of the emulsifiers.

A series of nonionic, anionic, and cationic synthetic surfactants, most of which were ethylene oxide adducts of alkyl, aryl, and alicyclic compounds containing various functional groups, were tested on a laboratory and pilot-plant scale as emulsifiers in the polymerization of butadiene and styrene according to typical GR-S formulae.

The anionics yielded good polymerization rates with satisfactory latex stability; the cationics afforded good rates with poor latex stability; and the nonionics in general gave poor rates with variable latex stability. The polymers were equal or inferior to GR-S made at the same temperature as that for the experimental emulsifiers.

The data obtained should afford a choice of emulsifiers for the preparation of fatty or rosin acid-free latices or polymers for special purposes and should provide a background and starting point for further studies of these types of emulsifiers.

4:15 p.m.—8. **Peroxides from Autoxidized Methyl Oleate and Linoleate as Initiators in the Preparation of Butadiene/Styrene Synthetic Rubber.**[6] **Daniel Swern,** Jos. E. Coleman, H. B. Knight, Eastern Regional Research Laboratory, United States Department of Agriculture, Philadelphia 18, Pa.; K. T. Zilch, H. J. Dutton, J. C. Cowan, Northern Regional Research Laboratory, U. S. Department of Agriculture, Peoria, Ill.; and J. M. Gyenge, Government Laboratories, University of Akron.

In a dextrose-free recipe at 41°F. for the copolymerization of butadiene and styrene, using 6 x 10^{-4} moles of initiator per 100 grams of monomers, methyl oleate peroxide (MOP) and methyl linoleate peroxide (MLP) gave higher polymerization rates and conversions than cumene hydroperoxide (CHP), and they gave as high rates of conversion as *p*-menthane hydroperoxide (PMHP). In a peroxide-dextrose recipe at 122°F., at both low and high dextrose levels, only about one-half as much MOP as CHP or PMHP was employed on a molar basis to achieve the same conversion and polymerization rate. In a low dextrose-Redox recipe at 41°F., using 6 x 10^{-4} moles of initiator per 100 grams of monomers, MLP gave slightly higher conversions than CHP or PMHP, but in the amine recipe at 41°F. MLP gave lower conversions.

4:35 p.m.—9. **Tensile Properties of Films from GR-S Latex Polymerized at Low Temperatures. R. W. Brown,** W. E. Messer, L. H. Howland, Naugatuck Chemical.

Studies were made on the influence of a number of polymerization variables on the tensile strength of vulcanized films from low-temperature high-solids GR-S latices. Previous reports of film tensiles on the order of 3,000 pounds per square inch for latices of 70/30 butadiene/styrene charge ratio were confirmed. The levels of accelerator necessary for optimum vulcanized properties were found to be considerably lower than those normally used, particularly for latices shortstopped with dithiocarbamate salts. Microscopic coagulum found in some latex samples had a pronounced effect in decreasing film tensile of vulcanizates.

Cured films from latices emulsified with mixtures of fatty acid and rosin soap possessed considerably better tensile strengths than those from latices using all fatty acid soap emulsification. Wide variations in Mooney viscosity had relatively little effect on ultimate film properties. Incorporation of small amounts of lignin into the latex as the ammonium or sodium salt decreased cure rates of films and aided in giving more reproducible tensile results. Both lignin and the sodium salt of cresyl monosulfide improved the aging characteristics of films.

Thursday Morning—October 30

9:00 a.m.—10. **A Study of Electrical Contact Potentials Produced during Banbury Mixing. R. S. Havenhill,** L. E. Carlson, H. F. Emery, J. J. Rankin, St. Joseph Lead Co., Monaca, Pa.

The use of the electrostatic probe and associated equipment in monitoring and recording the electrical potentials of a rubber batch during mixing was reported previously. It was shown that these potentials were related to the mixing behavior of the batches.

Further studies have been made using the original equipment in which the probe was located in the side of the Banbury mixing chamber between the two rotors. Additional work has been carried out with the probe in the door of the mixing chamber. In this new location the potential was measured where the rubber was squeezed between the rotor and the shell, and maximum pressures and shearing stresses were encountered.

Differences in both magnitude and polarity of charge were found between the two probes.

Contact potential studies showed a positive charge on coated zinc oxide and coated calcium carbonate pigments. The resulting electrostatic attractive forces between the positive pigment and the negative rubber are thought responsible for the faster incorporation, better dispersion, and lower power consumption.

Electrostatic mixing charts for a chemical plasticizer indicate the plasticizing action to be an oxidation reaction similar to mastication.

Electrostatic mastication charts are shown for vinyl chloride and silicone rubber.

9:20 a.m.—11. **Active Carbons as Anti-Stain Agents for Reclaimed Rubber. J. J. Keilen** and W. K. Dougherty, West Virginia Pulp & Paper Co., Charleston, S. C.

The discoloration of light-colored stocks due to migration of staining materials from reclaimed rubber in adjacent stocks, as in white sidewall tires, can be reduced by incorporating active carbon in the reclaim. Over a range of 6-15 parts of active carbon per 100 parts of GR-S reclaim or blends of GR-S with up to 50% of natural rubber reclaim, particle size within the standard sieve range and moisture content up to 28% have no effect on the anti-stain activity of the carbon.

In the standard sieve range, particle size does not affect Mooney viscosity of the stock. Acidic active carbons are more effective in GR-S reclaim and in blends with natural rubber reclaim than are alkaline carbons. In natural rubber reclaim the effect of pH is negligible.

Variation in molasses value of Type A carbon, a measure of decolorizing ability, has no apparent effect on anti-stain activity. The anti-stain activity of Type B carbon is related to iodine value, a measure of power to remove tastes and odors from water, with increased iodine value giving greater anti-stain effect. Among commercial grades of active carbons, Type A is more effective than Type B, especially in blends containing high percentages of GR-S. The effective specific gravity of active carbon in rubber is 1.45.

9:40 a.m.—12. **Blends of Chlorosulfonated Polythene[7] with Butadiene-Styrene Copolymers. W. I. Remington,** J. J. Ondreicin, George H. Bowers, du Pont, Wilmington, Del.

Vulcanizates of chlorosulfonated polythene possess unusual mechanical durability and chemical stability. When compounded in blends, chlorosulfonated polythene is capable of improving butadiene-

[3] General Dyestuff Corp.
[4] Monsanto Chemical Co.
[5] This work was done at Government Laboratories, University of Akron, under the sponsorship of Office of Synthetic Rubber, RFC.
[6] Part of this work was carried out under the sponsorship of the Synthetic Rubber Division in connection with the government synthetic rubber program.
[7] Distributed as "Hypalon" S-2 chlorosulfonated polythene; "Hypalon" is a registered trade mark of E. I. du Pont de Nemours and Co., Inc.

styrene copolymers in important respects. GR-S-101 blends containing 25% or more chlorosulfonated polythene are of particular interest. In tread stock compositions the addition of chlorosulfonated polythene improves ozone resistance and abrasion resistance, as well as heat aging characteristics.

The development of a suitable curing system for these blends presents unusual problems because of gross differences in the chemical structures of the individual elastomers. The use of conventional GR-S formulations gives poor stability, presumably because dehydrohalogenation of the chlorosulfonated polythene is induced by zinc chloride that is formed. Improved vulcanizates are obtained in blends when all zinc oxide is replaced by litharge. By minor variations in the rest of the composition, vulcanizates can be obtained that exploit the better characteristics of both elastomers. Field evaluations of these blends have been started in connection with a number of uses where ozone resistance is particularly important.

10:05 a.m.—13. **Ozone Resistant Chlorosulfonated Polythene Blends. R. T. Currin,** W. J. Remington, W. B. Clark, du Pont.

Unsaturated elastomers are susceptible to ozone attack, and the resulting cracks, if not severe in themselves, are easily propagated by the dynamic conditions frequently encountered in elastomer service. A surprising degree of resistance to the initiation of ozone cracks can be obtained in vulcanizates comprising blends of major portions of the unsaturated elastomers with chlorosulfonated polythene, a new elastomer highly resistant to such degradation.

The proportion of chlorosulfonated polythene required for lasting protection against the start of ozone cracking is dependent upon exposure conditions such as the stress on the sample, the temperature, and the ozone concentration. When stresses are low as 50 p.s.i. some blends containing only 25% chlorosulfonated polythene are resistant at room temperature to high ozone concentrations for long periods. At high stresses or temperatures, however, higher portions of chlorosulfonated polythene are needed for comparable performance.

These results raise fundamental questions regarding the mechanism by which protection against ozone is obtained. They also emphasize the importance of minimizing stress concentrations in fabricated articles and of considering the effect of slightly elevated service temperatures on ozone attack. In conclusion, the data provide a basis for formulating compositions of any desired degree of ozone resistance.

10:30 a.m.—14. **Compounding of Silicone Rubber—II.** Walter B. Spencer, Wm. B. Davis, **F. L. Kilbourne, Jr.,** Connecticut Hard Rubber Co., New Haven, Conn.; and Juan Montermoso, Office of the Quartermaster General.

In this paper data are presented showing (a) improvements in physical properties of silicone compounds, (b) the effect of time and temperature of curing of silicone compounds, (c) the effect of pigment surface pH and moisture on physical properties, (d) a new method for simultaneously reinforcing and vulcanizing silicone rubber in the absence of peroxidic agents.

The reinforcing properties of silica aerogel, titanium dioxide, pure aluminum oxide, and a new hydrophobic silica in dimethyl silicone elastomer are compared; unusually high tensile strengths and elongations are obtainable with aluminum oxide and hydrophobic silica.

The rate of cure of a typical silicone compound has been studied; a press cure of 15 minutes at 230° F. is recommended.

10:55 a.m.—15. **Purchase and Inspection Standards for Dry Natural Rubber. W. J. Sears,** Rubber Manufacturers Association, Inc., New York, N. Y.; and C. O. Miserentio, Dunlop, Buffalo.

In purchasing natural rubber there is no means of determining its acceptability from a technical standpoint before title passes from the seller to the buyer. For other materials used by the rubber industry, there have been developed scientific methods of material evaluation, and enforceable purchase specifications are written for technically determining their acceptability.

The best available enforceable purchase specifications for natural rubber are the use of the standard contract, type samples, type descriptions, and packing specifications prepared by the RMA Crude Rubber Committee. The use of these standards, together with adequate inspection procedures, will assure factories of receiving contract grades.

Naked eye inspection is used to compare samples taken from rubber shipments with official RMA-type samples for resemblance. During 1951 about 42% of nearly one-half million long tons of natural rubber imported was off-grade; 11% was non-bona fide tenders. Currently, outstanding claims against Far Eastern shippers for off-grade rubber amount to approximately $1,500,000. Practically all natural rubber produced can be physically graded into one or another of the RMA types and grades. Many Far Eastern packers and shippers refuse to grade their rubber according to these standards. Under these conditions many factories are accepting rubber of a lower grade than they ordered and paying more for their rubber than its true value.

The RMA Crude Rubber Committee is sponsoring a series of nation wide educational seminars for the rubber manufacturing industry to acquaint it with these standards. Provided more companies in the industry adopt them and insist upon proper deliveries, there should be a general improvement in the quality and uniformity of natural rubber shipments from the Far East.

In addition, it is believed that companies using these standards will have an equal opportunity to be competitive from a rubber cost standpoint. It is hoped that rubber chemists will take a renewed interest in rubber procurement and work with their buyers to improve the quality and packing of the shipments.

This industry effort will not solve the problem of technically non-uniform natural rubber, but should assure companies of better deliveries and provide greater opportunity for lowering natural rubber cost.

11:15 a.m. **Goodyear Metal Award Lecture. "Out of the Past." H. E. Simmons,** Akron.

THURSDAY AFTERNOON—OCTOBER 30

2:00 to 5:00 p.m. **Trips to plants** in the Buffalo area of interest to members of the Division of Rubbber Chemistry will be arranged.

5:00 p.m. **Suppliers' Cocktail Party**—Hotel Statler.

7:00 p.m. **Banquet of Division**—Hotel Statler. Presentation of Goodyear Medal to Dr. Simmons. Entertainment.

FRIDAY MORNING—OCTOBER 31

9:00 a.m.—16. **Characterization of Cord Fatigue in Tires. K. R. Williams,** J. W. Hannell, J. M. Swanson, du Pont, Richmond, Va.

The mechanism of fatigue failure of rayon cords was studied by the characterization of cords removed from fatigued, but unfailed passenger tires. Fatigue failure was found to stem from a progressive loss in cord strength in the flex zone. This loss in strength was linear with tire mileage and was caused by broken filaments. Studies of single fiber strength and stiffness, cellulose chain length, and fiber abrasion were also made on fatigued tire cords.

The linear loss in cord strength was induced in the laboratory with an in-rubber fatigue test by adjusting the degree of cord extension and compression in the tester to approximate the values found in the sidewall of a passenger tire. Under these conditions the tester gave good correlation with tire data with respect to the relative rate of strength loss of cotton and rayon cords and the effect of cord twist on fatigue life.

9:25 a.m.—17. **Study of the Factors Affecting the Friction of Tread Compounds on Ice. C. S. Wilkinson, Jr.,** Goodyear Tire & Rubber Co., Akron.

The use of various synthetic polymers in tire treads makes it highly desirable to have some means of evaluating their frictional properties on ice. Because of the natural variability of conditions encountered in highway tests a laboratory method in which variables could be controlled was developed.

It was found that differences observed in the frictional characteristics of a particular tread stock due to variations in load and temperature may exceed differences between it and stocks from other polymers under identical test conditions. The velocity of sliding, including the special case of "static friction" where the velocity is zero, was also found to have a considerable effect. When these variables were controlled, differences in compounds remained due to the polymer used or some physical characteristic of the sample. The hardness seemed to be the physical property having the greatest effect upon the ice friction.

Since considerable difficulty was experienced in producing a uniformly satisfactory ice surface for experimental purposes, some space has been devoted to consideration of this special phase of the experiment.

From experimental observations made, it is possible to draw some conclusions concerning the proper method of testing and comparing compounds. In addition, some insight into the mechanism of the frictional forces may be obtained. A theory prevalent in the field of the friction of metals that friction consists of a process of alternately welding and breaking junctions between surface asperities seems consistent with most of the observed phenomena in the case of rubber and ice. The fact that the coefficient is a variable, depending on such factors as pressure, temperature, and velocity, is explainable on the basis of the water film formed when rubber slides on ice. The existence of this film may also account for the differences between so-called "static" and "kinetic" friction.

9:50 a.m—18. **Behavior of Motor Mounting Compounds under Continuous Shear Load. G. L. Hall,** F. S. Conant, J. W. Liska, Firestone.

A description is given of an apparatus and method for testing elastomers to be used under continuous load. A shear-type loading, corresponding to most service applications, is used. Serviceability is judged on the basis of two parameters, the amount

of creep under continuous load, and the change in tangent modulus. Test duration and test temperatures simulating service conditions are utilized, thus minimizing the dangers inherent in extrapolations from the results of highly accelerated tests.

Creep rate was found practically unaffected by the changes in applied stress or in sample length studied. A butyl rubber compound tested showed excellent retention of modulus and comparatively low creep after long periods of time under load. A butadiene/acrylonitrile compound also showed a low creep, but a very high degree of stiffening. Antioxidant studies in GR-S showed PBNA[8] and BLE[9] to be equivalent to each other. An increase in PBNA content made a slight increase in resistance to heat stiffening, especially at 70° C. In *Hevea* compounds Santoflex B,[4] BLE, and PBNA appeared to be equally effective. The difference in aging characteristics between *Hevea* and GR-S rubbers was shown clearly.

10:10 a.m.—19. **Electrical Conductivity of Rubber—Carbon Black Vulcanizates. B. B. S. T. Boonstra** and E. M. Dannenberg, Godfrey L. Cabot, Inc., Boston, Mass.

Electrical conductivity measurements are reported on a group of fine particle size reinforcing carbon blacks at various loadings in natural rubber, cold GR-S, and Neoprene GN-A.

For practical applications, a conductive rubber stock should have the following characteristics: (a) low resistivity, (b) small charges in resistivity with temperature and (c) small changes in resistivity on deformation.

The retention of conductivity after deformation is a very important property. It is well known that rubber-black compounds containing the usual commercial grades of black undergo tremendous changes in electrical resistance even at small deformations of the test specimen. Since these properties depend for a great part on the type of black used in the compound, the most commonly used conductive blacks were tested together with two new blacks, Vulcan C and Vulcan CC.

The most conductive commercial grade of channel black shows some conductivity even at loadings as low as 10 parts per 100 parts of rubber; whereas the other blacks at this loading have resistivities which do not differ greatly from the pure gum values.

The conductivity of Vulcan CC mixes showed the smallest temperature dependence.

The retention of conductivity under deformation of stocks containing 50 parts of black in natural rubber was extensively studied. Three different types of deformation were applied: slow elongation, repeated rapid elongation, and repeated rapid compression.

During the slow elongation test the resistivity plotted *vs.* elongation goes up rapidly at first, through a maximum, the height and position of which are dependent on the type of black.

Repeated rapid elongation results in less drastic changes in resistivity and shows characteristic differences in resistivity level among the various blacks.

Compression results in very large changes in resistance, especially at the first few deformation cycles. The rate of compression plays an important part in the rise in resistivity resulting from it. The results tie in with the theory that conductivity is caused by conductive paths which are partly destroyed by deformation, but, at the same time, are constantly being reformed. A new type of black, Vulcan CC, was shown to give rubber stocks possessing the lowest resistivity and the least change in resistivity during deformation.

10:35 a.m.—20. **Cross-Linking in Natural Rubber Vulcanizates. H. E. Adams** and B. L. Johnson, Firestone Tire & Rubber Co.

The cross-linking of natural rubber vulcanizates containing varying proportions of the typical compounding ingredients has been determined. Comparison of this cross-linking data with the amount of combined sulfur and zinc sulfide produced in the various vulcanizates reveals the following relations.

For a definite sulfur concentration the cross-linking (in the absence of degradation) is directly proportional to the amount of soluble zinc present in the vulcanizate. The amount of zinc sulfide produced is a measure of the degradation reactions, since a mole of zinc sulfide is produced for each mole of cross-linking destroyed. Thus the original amount of cross-linking produced is equal to the sum of the amount of zinc sulfide formed and the experimentally determined cross-linking. At high levels of soluble zinc a maximum amount of cross-linking is obtained from a definite level of sulfur which corresponds to two sulfur atoms per cross-link. At lower zinc levels the ultimate ratio of combined sulfur to cross-linking is much larger than two. Thus it is possible by the proper choice of sulfur and soluble zinc concentrations eventually to utilize all the sulfur in cross-linking. The overall stoicheometry of the cross-linking reaction is one zinc atom and two sulfur atoms for each cross-link formed.

11:00 a.m.—21. **Chemical Analysis of GR-S by Complete Solution Procedures. Frederic J. Linnig,** Jean M. Peterson, Demby M. Edwards, Walter L. Acherman, National Bureau of Standards, Washington, D. C.

A scheme is presented for the analysis of the gross chemical constituents of uncompounded GR-S synthetic rubber. A five-gram sample is dissolved in a 5:1 mixture of toluene and ethanol and made up to a final volume of 250 milliliters.

The stabilizer content of the samples is determined by means of a spectro-photometric procedure on a three-milliliter aliquot of this solution diluted to 100 milliliters with methylcyclohexane. Organic acid is determined on a 100 milliliter aliquot by titration with 0.1N alcoholic NaOH following dilution with 70 milliliters of solvent. The remaining 147 milliliters of the original solution are diluted with 100 milliliters of solvent and titrated for soap with 0.05N alcoholic HCl. The color changes of meta cresol purple are used to determine the endpoints in both titrations.

The bound styrene content of the polymer is determined by measurement of the refractive index of a piece of rubber purified by precipitation from the titrated soap aliquot with an 85:15 mixture of isopropanol and water. With the aid of corrections for ash and moisture a complete analysis of the gross polymer and non-polymer constituents of the sample may be made.

11:20 a.m. **Business Meeting of the Division.**

FRIDAY AFTERNOON—OCTOBER 31

2:00 p.m.—22. **A Quantitative Study of the Reaction of Ozone with GR-S Rubber and Various Antioxidants. E. R. Erickson,** R. A. Berntsen, E. L. Hill, Augustana Research Foundation, Rock Island, Ill.

There are many ways of analyzing the results of the action of ozone on rubber, but none of these gives the quantitative amounts of ozone that will attack a given sample. A method is proposed, and an apparatus has been built for the quantitative determination of the ozone absorption by a weighed substance. The sample is deposited by the principle of chromatography on a column of silica gel. Ozonized air of a known concentration (25 to 2500 ozone pphm.) is passed through the sample on the column, and the residual ozone in the air stream is continuously titrated with sodium thiosulfate until the ozone concentration has returned to the initial value. A blank determination is first made to determine the initial rate of flow of ozone in the air stream in the apparatus.

By the use of this method, determinations were made of the quantity of ozone reacting with samples of various unvulcanized GR-S rubbers. It appears that the carbon-carbon double-bonds in the hydrocarbon chains take up one mole of ozone per double-bond. The benzene rings are not attacked. The reactions of ozone with various compounds, which can be milled into rubber to act as antioxidants, are reported.

2:20 p.m.—23. **The Permeability of Different Elastomers to Gases Using Carbon-14. A. D. Kirshenbaum** and A. G. Streng, Temple University, Philadelphia, Pa.; and W. B. Dunlap, Jr., Lee Rubber & Tire Corp., Conshohocken, Pa.

It is well known that rubber membranes are permeable to gases and that the rate of permeation is specific for a given gas and rubber. The permeability of gases through rubber is due to the dissolving of the gas molecules into one side of the rubber membrane followed by diffusion of the gas through the membrane and evaporation of the gas on the other side.

The permeability of butyl, GR-S, natural, and a low styrene type of rubber to air and carbon-14 labeled carbon dioxide was determined. The procedure and apparatus used will be described. The rate of permeability employing radioactively labeled gases was determined in three to five hours at 50 to 75° C. and about 16 hours at 27° C. By the use of this radioactive technique it was found that the differences in permeability of the various elastomers to a given gas are due mainly to the differences in the rate of diffusion and only slightly to the differences in solubility and rates of evaporation.

The effects of pressure, temperature, elongation, water, and density were studied. It was found that pressure, temperature, and elongation all had a linear effect on the permeability, with temperature and elongation having a much greater effect than pressure. The permeability of gases increased with increase in density and decreased with increase in water content.

2:40 p.m.—24. **Study of Mercaptobenzothiazole Vulcanization Using Sulfur-35. I. Auerbach,** Goodyear.

A study has been made to determine the function of mercaptobenzothiazole (MBT) in the vulcanization process. Radioactive sulfur-35 and MBT tagged with sulfur-35 were used for measuring the sulfur and MBT reaction rates.

The effect of fivefold variations in the zinc oxide, sulfur, and MBT concentrations on the sulfur combining rate was measured. The rate was found to be

[8]Phenyl beta naphthylamine.

[9]Naugatuck Chemical Division, United States Rubber Co.

dependent on the initial sulfur and MBT concentrations and independent of the zinc oxide concentration within the concentration ranges studied. The ratio of combined sulfur to reacted MBT is constant during the course of the reaction as long as both reactants are present.

When the vulcanization reaction is attempted in a saturated medium such as polyisobutylene, the final product is the zinc mercaptide of MBT. This reaction is very rapid and takes place within the first minute of heating at 140° C. The zinc mercaptide is not found when GR-S is used except at very low sulfur concentrations.

It was found that the zinc mercaptide reacts with sulfur in an unsaturated medium to regenerate MBT. The reaction was studied in GR-S, decene, and isododecylene. Since the hydrogen involved in the regeneration of the MBT comes from the hydrocarbon, it is suggested that the hydrocarbon in its activated form then reacts with sulfur.

The experimental result which indicate that the MBT zinc mercaptide is an intermediate in the vulcanization process were substantiated when the mercaptide was substituted for MBT, and the same sulfur combining rate was obtained. Further evidence is found in kinetic equations which account for the data.

3:05 p.m.—25. **The Triangular-Phase Diagram for Copolymer Solvent Systems. F. W. Boggs,** U. S. Rubber, Passaic, N. J.

The evaluation of any solvent-resistant rubber must be based, at least in part, on a measurement of the amount of swelling which it undergoes when in contact with a solvent which it should resist. In the absence of any theoretical knowledge it is necessary to test a large number of polymers and copolymers before a promising system can be chosen for detailed study. This situation can be greatly improved by some simple theoretical considerations.

It is shown in this paper that the study of the swelling of copolymers can be advanced by constructing a triangular-phase diagram of the type frequently used in three component phase studies. The effect of different solvents and copolymers on the phase boundaries in the diagram are discussed. Particular emphasis is given to the influence of the cohesive energy density and to the degree of cross-linking.

In one particular case, chosen for its practical importance and ease of calculation, the phase diagram is calculated theoretically using the methods developed by the author[10] for the calculation of the chemical potential of solvents in polymer systems. The results are shown to be in good agreement with those obtained for the butadiene-acrylonitrile system.

3:25 p.m.—26. **Second-Order Transition Temperature of Butadiene Copolymers. R. H. Gerke,** U. S. Rubber.

Second-order transition temperature of copolymers of butadiene and the following monomers: acrylonitrile, styrene, and methyl acrylate, have been determined using the dilatometer method. Mercury or 38% sulfuric acid was used as confining fluids.

It has been found that the logarithm of the second-order temperature in degrees K. is a linear function of the weight fraction of monomer. A thermodynamic discussion of second-order transition temperatures is given. Second-order transition temperatures from dimensional measurements are about 3° C. higher than those from published heat capacity data.

[10] *J. Chem. Phys.*, 20, 632 (1952).

Rubber & Plastics Division, ASME, Chicago Meeting

A MEETING of the Rubber & Plastics Division of the American Society of Mechanical Engineers was held September 8, at the Hotel Sheraton, Chicago, Ill., as part of the fall meeting of the parent Society. Two half-day technical sessions comprised the program and were very well attended, not only by American engineers, but by many engineers from abroad present for the Centennial of Engineering held in Chicago the week of September 8. Glen W. Neely, The Richardson Co., is chairman of the Rubber & Plastics Division.

The first session had H. A. Winkelmann, Dryden Rubber Division, Sheller Mfg. Co., as chairman, and Paul F. Niessen, Victor Mfg. & Gasket Co., as vice chairman.

"**Stress Relaxation in Compression of Rubber and Synthetic Rubber Vulcanizates Immersed in Oil,**" by J. R. Beatty and A. E. Juve, B. F. Goodrich Co. Research Center, reported that stress relaxation studies for compounds of various polymers in compression immersed in oil showed that continuous stress relaxation is inhibited by the presence of oil and that unconfined swelling measurements predict the degree of inhibition directly. The variables of temperature and type of oil were investigated.

"**Present and Future Requirements of Rubber-like Materials for a Global Air Force,**" by E. R. Bartholomew, Wright Air Development Center, was the other paper of this session. Mr. Bartholomew described the particular and peculiar requirements of the Air Force for rubber-like materials and the problems now presented by the use of jet engines in high-speed aircraft. Some discussion of compound formulation was included in this paper.

The second session was in charge of A. G. Susie, Armour Research Foundation, Illinois Institute of Technology, with Paul McGerty, Richardson Co., as vice chairman.

"**Closed Mold Molding Techniques,**" by Edward F. Borro, Durez Plastics & Chemicals, Inc., was the first paper on the afternoon program. Details of studies made by Durez on the best techniques for pot-type transfer and plunger molding of thermosetting materials were described with special reference to shape and size of gates and runners, physical properties of the molding materials, sprues, mold density, etc.

"**Mechanical Properties of Glass-Cloth Plastic Laminates as Related to Direction of Stress and Construction of Laminate,**" by Fred Werren, United States Department of Agriculture's Forest Products Laboratory, was the second paper on this program. Methods are available for predicting the directional properties of glass-cloth plastic laminates from a knowledge of the properties associated with their natural axes, it was said. The mechanical properties of cross-laminated or composite laminates may also be calculated from the basic properties of the parallel laminates made of the component fabrics. Tests at the Forest Products Laboratory have shown that the suggested methods are reasonably correct for the range of glass-cloth plastic laminates presently being used in aircraft.

"**Effect of Preloading and Fatigue on Mechanical Properties of Glass-Cloth Plastic Laminates,**" by A. D. Freas, Forest Products Laboratory, was the final paper on the program. It was reported that tensile tests of glass-cloth plastic laminates showed that modulus of elasticity and proportional-limit stress may be changed considerably after the first application of stress. A small number of pre-loads, in either tension or compression, have no appreciable effect on the strength of the laminate. The application of many repeated or reversed stresses, however, may result in a fatigue strength that is much lower than the static strength of the material.

At the meeting of the executive committee of the Division, Fred Wehmer, Minnesota Mining & Mfg Co., was elected a member of that committee.

The next meeting of the Rubber & Plastics Division will be held in conjunction with the annual meeting of the Society in New York, N. Y., November 30 through December 5.

Rubber in Army Vehicles

A TALK on "The Application of Rubber in Military Vehicles" by Everette Baugh, General Motors Corp., featured the September 11 dinner-meeting of the Southern Ohio Rubber Group. The meeting, held at the Engineers' Club, Dayton, was attended by 117 members and guests.

Mr. Baugh discussed and showed samples of rubber parts used in the Walker Bulldog tank. Pictures were also shown of the tank in operation. The talk was general in nature, since much of the specific information on performance of the rubber parts and the tank is restricted or classified. Following the talk came a showing of the sound film, "Fishing in Alaska," through the courtesy of Nash Motor Co.

In the business session preceding the talk, J. E. Feldman, Inland Mfg. Division, General Motors, and Group chairman, announced the appointment of the following nominating committee for the 1952-53 slate of officers: Harry Brubaker, Witco Chemical Co.; L. J. Fitzharris, Frigidaire Division, General Motors; Ray Jacobs, Premier Rubber Mfg. Co.; Frank Newton, Dayton Rubber Co.; W. A. Smith, Precision Rubber Products Co.; and Bob Thome, Inland Mfg.

Group Program Service

IN NOTICE No. 3 to all Rubber Group secretaries, S. G. Byam, vice chairman, Division of Rubber Chemistry, A. C. S., announced in connection with the Rubber Group Program Service that B. S. Garvey, Jr., laboratory director of Sharples Chemicals, Inc., sales service laboratory, Wayne, Pa., plans to talk in November to the Los Angeles and the Northern California Rubber groups on the following subjects. "Accelerator Compounding" and "The Compounder in the Rubber Industry."

Dr. Garvey has advised that he would be willing to repeat these talks before other rubber groups, if requested. Both talks are designed for 50 minutes' delivery and require a lantern for standard slides.

Groups interested in these papers should write Dr. Garvey directly.

More Group Outings

Hawaiian Luau for TLARGI

SOME 229 members and guests attended the annual summer outing of The Los Angeles Rubber Group, Inc., held at the Hotel Del Mar, Del Mar, Calif., on June 7 and 8. Acclaimed as the finest in the Group's history, the outing had a Hawaiian theme, and every person attending was given a sport shirt of Hawaiian style. The outing program began with a luncheon on June 7, followed by an afternoon of sports, including tennis, softball, horseshoes, ping pong, shuffleboard, badminton, and swimming. The day concluded with a dinner and entertainment program. A golf tournament with 69 participants was held on the morning of June 8; while other activities were available for non-golfers. The outing ended with a luncheon at which some 70 prizes were distributed to winning contestants from funds contributed by 135 rubber and supplier companies.

D. C. Maddy, Harwick Standard Chemical Co., was general chairman of the arrangements committee and was assisted by the following subcommittee chairmen: ticket sales, E. C. MacLaughlin, H. M. Royal, Inc.; prizes and favors, A. H. Federico, C. P. Hall Co.; reception, C. S. Hoglund, R. D. Abbott Co.; entertainment, Ted Kyle, Plastic & Rubber Products Co.; sports, Stan Freeman, Witco Chemical Co.; publicity, L. E. Budnick, Ohio Rubber Co.; and golf, C. R. Wolter, California Rubber Products, Inc.

Record Crowd for Philadelphia

A RECORD attendance of 171 members participated in the annual outing of the Philadelphia Rubber Group, held at the Cedarbrook Country Club on August 22. A feature of the outing was a golf tournament in which 85 members took part. The prize for low gross in the tournament was won by Ed Osborne, B. F. Goodrich Chemical Co.; while the high gross prize went to Ralph Harper, Naval Aero Materials Laboratory. The outing concluded with a cocktail hour and dinner, followed by the distribution of door prizes to everyone attending.

G. J. Wyrough, R. E. Carroll Co., was chairman of the outing committee, with R. A. Kurtz, E. I. du Pont de Nemours & Co., Inc., in charge of prizes; W. R. Cleary, Barrett Division, Allied Chemical & Dye Corp., in charge of golf; and A. J. DiMaggio, Firestone Tire & Rubber Co., in charge of donations.

Connecticut Group Outing

THE seventh annual outing of the Connecticut Rubber Group was held September 13 at Grassy Hill Park, Derby, Conn. Some 170 members and guests took part in the program of events, which included a golf tournament, softball game, horseshoes, egg throw, and other field activities. The outing concluded with a buffet supper, and the distribution of contest and more than 120 door prizes made possible by the contributions of some 95 rubber and supplier companies.

In the horseshoe pitching contest, first prize went to R. E. Blake, United States Rubber Co., and second prize to N. F. Riley, also of U. S. Rubber. The egg throw was won by the team of S. Ericksburg, Monsanto Chemical Co., and F. F. Villa, Accurate Insulated Wire Co. The Naugatuck team defeated the peddlers in the annual softball game. Golf tournament prizes were as follows: low gross, C. R. Ekwall, U. S. Rubber; low net, S. B. Boyd, U. S. Rubber; and high gross, R. Potter, M. B. Mfg. Co. Ray Dudley, Whitney Blake Co., chairman of the outing committee, was assisted by Dave McKean and Whitey Larson, both of Whitney Blake, and George Sprague and Guy DiNorscia, both of Sponge Rubber Products Co.

Szegvari, Fisher to Speak

THE fall meeting of the New York Rubber Group scheduled for Friday, October 24, at the Henry Hudson Hotel, New York, N. Y., will hear two papers at the afternoon session, which begins at 4:00 p.m.

The first speaker will be A. Szegvari, Union Process Co., who will discuss "Fine Grinding of Latex Dispersions." The second talk, to be given by Harry L. Fisher, Office of Synthetic Rubber, Reconstruction Finance Corp., will deal with "Latest Developments in Synthetic Elastomers."

A social hour and cocktail party will precede the dinner, the latter to begin at 7:00 p.m. and to be followed by an entertainment program.

Chicago Rubber Courses

THE Chicago Rubber Group is cooperating with the faculty of the Illinois Institute of Technology in setting up evening courses in rubber technology. The program calls for a two-year basic course designed for personnel having a high school education, and a one-year advanced course intended for personnel having at least two years of college training or its equivalent in practical experience in the rubber industry. The first year of the basic course is being offered this fall at IIT, and the response will determine whether the other courses will be offered.

The first year of the basic program consists of two courses: CHE-65, general chemistry and general mathematics on the first-year college level, with special emphasis on applications in rubber technology; and CHE-66, basic physical concepts and their relation to the evaluation of rubber vulcanizates. Each of these two courses is given one evening a week. The second year of the basic program consists of two courses on the principles of rubber compounding and includes two lecture hours and three laboratory hours a week. These courses, CHE-165 and -166, deal with the properties, compounding, processing, and uses of natural and common synthetic rubbers. The advanced program also consists of two courses: CHE-465, a weekly seminar on theoretical aspects of compounding, with guest lectures from industry; and CHE-466, a weekly laboratory course on compounding problems from the development viewpoint.

Experimental Oil-Masterbatch Program

IN ORDER to allow consumers of oil-masterbatch an opportunity to determine the interchangeability of processing oils currently in use, the entire oil-masterbatch program has been placed on an experimental basis by the Office of Synthetic Rubber, RFC, effective August, 1952. All regular numbers assigned to oil and oil-black masterbatches have been cancelled, and only those experimental masterbatches listed herewith will be produced. Processing oils to be evaluated are Circosol-2XH, Sundex 53, Shell SPX-97, Dutrex 20, and Califlux TT. On January 1, 1953, all X-numbers which have the same base polymer, and equal quantities of processing oils determined to be equivalent, will be consolidated into a single permanent GR-S number which will incorporate the equivalent oils on an interchangeable basis.

The listed polymers are experimental only, and the Office of Synthetic Rubber does not make any representations or warranties of any kind, expressed or implied, as to their specifications or properties, or the results to be obtained from their use.

Oil Masterbatches

X-No.	Polymer Description
X-628	25 parts Circosol-2XH + 100 parts high Mooney 20% bound styrene polymer, sugar-free, iron activated, 50/50 rosin/fatty acid emulsified, carbamate short-stopped, 41° F. reaction temperature, staining stabilizer. Mooney of masterbatch, 50-70 (ML-4).
X-654	Same as X-628, except Shell SPX-97 used instead of Circosol-2XH.
X-712	Same as X-628, except Sundex 53 used instead of Circosol-2XH.
X-700	Same as X-628, except Dutrex 20 used instead of Circosol-2XH.
X-715	Same as X-628, except Califlux TT used instead of Circosol-2XH.
X-693	Same as X-628, but specifies Wingstay-S or equivalent as staining stabilizer.
X-713	Same as X-712, except rosin emulsified and slightly staining stabilizer.
X-714	Same as X-654, except rosin emulsified and slightly staining stabilizer.
X-716	37.5 parts Sundex 53 + 100 parts high Mooney 20% bound styrene polymer, sugar-free, iron activated, 50/50 rosin/fatty acid emulsified, carbamate short-stopped, 41° F. reaction temperature, staining stabilizer. Mooney of masterbatch, 45-65 (ML-4).
X-706	Same as X-716, except Shell SPX-97 used instead of Sundex 53.
X-717	Same as X-716, except rosin acid emulsified and Circosol-2XH used instead of Sundex 53.
X-718	37.5 parts Circosol-2XH + 100 parts high Mooney 23.5% bound styrene polymer, peroxamine activated, fatty acid emulsified, carbamate short-stopped, 41° F. reaction temperature, stabilizer Polygard or equivalent. Glue-acid coagulated. Mooney of masterbatch, 45-65 (ML-4).
X-709	50 parts Circosol-2XH + 100 parts high Mooney 20% bound styrene polymer, sugar-free, iron activated, 50/50 rosin/fatty acid emulsified, carbamate short-stopped, 41° F. reaction temperature, stabilizer Wingstay-S. Mooney of masterbatch, 55-75 (ML-4).

Oil-Black Masterbatch

X-629	50 parts HAF black + 25 parts Circosol-2XH + 100 parts high Mooney 20% bound styrene polymer, sugar-free, iron activated, 50/50 rosin/fatty acid emulsified, carbamate shortstopped, 47° F. reaction temperature, staining stabilizer. Compound Mooney of masterbatch, 55-75 (ML-4).

In another memorandum, September 26, OSR noted many consumers have requested an opportunity to evaluate oils other than Circosol 2XH at the 50-part level. To date, all requests have been for such a polymer using one of the highest aromatic oils of the group.

Accordingly, a pilot-plant run of a polymer similar to X-709, but incorporating 50 parts of Dutrex 20 and/or Califlux TT, will be made if sufficient requests are received. Evaluations of this polymer will be fitted into the program to establish interchangeability of oils at different levels and to develop more suitable oil and oil-black masterbatch polymers by January 1, 1953. The mean Mooney target for this proposed run will be 55 (ML-4) for the finished polymer. Consumers are asked to indicate any preference for either Dutrex 20 or Califlux TT and to use samples of each to determine their interchangeability at the 50-part level.

O-Ring Compound for Jet Aircraft

A NEW rubber compound said to be unaffected by synthetic lubricants used in jet aircraft has been announced by Precision Rubber Products Corp., Dayton, O. It was found that the synthetic lubricants of the dibasic ester type used in jet engines severly affect conventional synthetic rubber O-rings, and the company was asked to develop a suitable material. Research and development work on this problem resulted in Compound 142-70, which has been approved and placed in production for O-rings used in service with synthetic lubricants.

Compound 142-70 meets the requirements of specification MIL-R-7362 (USAF) for rubber products suitable for use with synthetic oils. Besides several manufacturers of jet engines and auxiliary equipment have approved the compound against their own particular specifications for synthetic lubricant service.

Akron Polymer Lectures

THE Akron Polymer Lecture Group is sponsoring a series of nine lectures to be given at 8:00 p.m. in Room 107, Knight Hall, University of Akron, Akron, O., on the dates shown. The lectures are as follows: September 5, "Polyelectrolytes as Soil Conditioning Agents," R. A. Ruehrwein, Monsanto Chemical Co.; October 3, "Hydrogenated High Polymers," W. B. Reynolds, Phillips Petroleum Co.; November 7, "Stabilization of High Polymers," C. B. Havens, Dow Chemical Co., December 5, "Structure *versus* Properties in Hydrocarbon Polymers," W. J. Bailey, University of Maryland; January 9, "Graft Polymerization," H. F. Mark, Polytechnic Institute of Brooklyn; February 6, "Polyester Resins," H. L. Gerhart, Pittsburgh Plate Glass Co.; March 6, "Butyl Rubber: Polymerization, Properties, and Applications," John Rehner, Jr., Esso Laboratories; April 10, "Applications of Magneto-Chemistry to Polymers and Polymerization," P. W. Selwood, Northwestern University; and date to be announced, "The Synthesis of Rubber by Plants," J. F. Bonner, California Institute of Technology.

Officers of the Lecture Groups Committee are: chairman, M. Morton, University of Akron; vice chairman, E. E. Gruber, General Tire & Rubber Co.; secretary, C. I. Parrish, Government Laboratories; treasurer, D. Druesedow, B. F. Goodrich Co.; and program chairman, J. W. Liska, Firestone Tire & Rubber Co. Other members of the Group are: R. A. Hayes and E. L. Carr, both of Firestone; W. C. Warner and E. F. Kalafus, both of General Tire; H. Tucker and T. R. Paxton, both of Goodrich; J. E. Field, P. M. Lindstedt, and R. M. Pierson, all of Goodyear Tire & Rubber Co.; A. F. Helin, Government Laboratories; and J. W. Sellers and W. R. Dial, both of Columbia-Southern Chemical Co.

CALENDAR

Oct. 15. Washington Rubber Group.
Oct. 15. New York Section, SPE. Hotel Gotham, New York, N.Y.
Oct. 17. Akron Rubber Group, Cleveland Section, SPE. Vinyl Symposium. Mayflower Hotel, Akron, O.
Oct. 17. Boston Rubber Group. Hotel Somerset, Boston, Mass.
Oct. 20-24. NSC. Fortieth National Safety Congress & Exposition. Chicago, Ill.
Oct. 20-26. Cleaner Air Week. Air Pollution Control Assn.
Oct. 24. New York Rubber Group. Henry Hudson Hotel, New York, N. Y.
Oct. 28. Assn. of Consulting Chemists & Chemical Engineers. Annual Symposium. Belmont Plaza Hotel, New York, N. Y.
Oct. 29-31. Division of Rubber Chemistry, A. C. S. Hotel Statler, Buffalo, N. Y.
Nov. 6-8. American Assn. of Textile Chemists & Colorists. Annual Meeting. Statler Hotel, Boston, Mass.
Nov. 11-19. National Foreign Trade Council. Waldorf-Astoria Hotel, New York, N. Y.
Nov. 12-14. American Council of Commercial Laboratories. Annual Meeting. Schenley Hotel, Pittsburgh, Pa.
Nov. 12. New York and Newark Sections, SPE. Hotel Gotham, New York, N. Y.
Nov. 14. Philadelphia Rubber Group. Poor Richard Club, Philadelphia, Pa.
Nov. 19. Washington Rubber Group.
Nov. 21. Chicago Rubber Group. Morrison Hotel, Chicago, Ill.
Nov. 25. Manufacturing Chemists Assn. Semi-Annual Meeting and Winter Conference. Statler Hotel, New York, N. Y.
Nov. 25. American Standards Assn. Annual Meeting. Hotel Waldorf-Astoria, New York, N. Y.
Nov. 30-Dec. 5. American Society of Mechanical Engineers. Annual Meeting, New York, N. Y.
Dec. 1-6. National Exposition of Power & Mechanical Engineering. Grand Central Palace, New York, N. Y.
Dec. 4. Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.
Dec. 12. New York Rubber Group. Christmas Party. Henry Hudson Hotel, New York, N. Y.
Dec. 12. Detroit Rubber & Plastics Group. Christmas Party. Sheraton Cadillac Hotel, Detroit, Mich.
Dec. 19. Chicago Rubber Group. Christmas Party. Morrison Hotel, Chicago, Ill.
Jan. 19-22. Plant Maintenance Conference and Show. (Special Rubber Industry Sessions, Jan. 20-21.) Public Auditorium, Cleveland, O.

Mowry Discusses Krilium

THE September 18 meeting of the Thiokol Technical Club at the company laboratories in Trenton, N. J., was featured by a talk by D. T. Mowry, Monsanto Chemical Co. Dr. Mowry, the inventor of the soil conditioner, Krilium, spoke on "Improvement of Soil Structure by Synthetic Polyelectrolytes."

A near-record attendance of about 100 guests enjoyed the social hour and dinner preceding the talk, and the meeting was further augmented by about 60 of the members of the Thiokol Corp. staff.

Dr. Mowry explained in some detail by means of slides and motion pictures the value of Kirilium as compared with other old type soil conditioners for improving soil aeration and moisture retaining properties so as to improve plant growth. The value of Krilium in preventing soil erosion was also described.

A lively discussion period followed.

Carbon Black Statistics—Second Quarter, 1952

Below are statistics for output shipments, producers, stocks, and exports of carbon black for the second quarter, 1952. Furnace blacks are classified as follows: SRF, semi-reinforcing furnace black; HMF, high modulus furnace black; FEF, fast extruding furnace black; and HAF, high abrasion furnace black. Statistics on thermal black are included with SRF black to avoid disclosure of individual company operations.

(Thousands of Pounds)

	April	May	June
Production:			
Furnace types:			
SRF	29,976	30,546	29,661
HMF	11,795	10,511	9,597
FEF	16,252	16,289	14,562
HAF	31,033	29,598	25,519
Total furnace	89,056	86,944	79,339
Contact types	51,047	45,688	47,860
TOTALS	140,103	132,632	127,199
Shipments:			
Furnace types:			
SRF	29,194	24,401	24,188
HMF	9,381	8,420	8,779
FEF	16,529	16,935	13,918
HAF	29,034	23,947	25,326
Total furnace	84,138	73,703	72,211
Contact types	37,465	33,133	34,440
TOTALS	121,603	106,836	106,651
Producers' Stocks, End of Period:			
Furnace types:			
SRF	31,699	37,844	43,317
HMF	25,902	27,993	28,811
FEF	27,207	26,561	27,205
HAF	28,210	33,861	34,054
Total furnace	113,018	126,259	133,387
Contact types	168,983	181,538	194,958
TOTALS	282,001	307,797	328,345
Exports:			
Furnace types	9,908	9,111	8,323
Contact types	13,248	13,200	9,444
TOTALS	23,156	22,311	17,767

SOURCE: Bureau of Mines, United States Department of the Interior, Washington, D. C.

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HAF (High Abrasion Furnace)

STATEX-R

◆

MPC (Medium Processing Channel)

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EPC (Easy Processing Channel)

MICRONEX W-6

◆

FF (Fine Furnace)

STATEX-B

◆

FEF (Fast Extruding Furnace)

STATEX-M

◆

HMF (High Modulus Furnace)

STATEX-93

◆

SRF (Semi-Reinforcing Furnace)

FURNEX

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NEWS of the MONTH

Although the Reconstruction Finance Corp., on September 1 raised the price of petroleum butadiene to 18¢ a pound from the existing 13¢ a pound, it seems quite likely that the price of GR-S will remain at 23¢ a pound for the next several months, at least. The 23¢ GR-S price appeared able to insure the RFC a good profit record for its copolymer plants for the current fiscal year and to make these plants attractive to private industry buyers if a disposal program is worked out in the first half of 1953. The higher butadiene price should have the same result for the petroleum butadiene plants while at the same time setting the stage for a higher GR-S price, if and when private industry took over the copolymer plants.

As part of the formulation of a synthetic rubber plant disposal program in 1953, RFC will have an outside engineering firm make an up-to-date appraisal of the "present value" of the plants. September GR-S production was set at about 45,000 long tons, and indications are that monthly production for the last quarter of the year will be at about that figure. LTP GR-S will amount to more than half of the 45,000 tons; in September it will be produced to the extent of 26,400 tons.

The rotation program for the national rubber stockpile by the General Services Administration is expected to permit selling and purchasing either through dealers or by rubber goods manufacturers themselves.

The Federal Trade Commission cited American Biltrite Rubber Co., B. F. Goodrich Co., Goodyear Tire & Rubber Co., and O'Sullivan Rubber Corp. for price discrimination in the sale of rubber heels, soles, and other products used in the shoe repair industry.

The Goodyear company has been selected by the Atomic Energy Commission to operate a $1,219,000,000 facility soon to be built in Pike County, O.

W. F. Bloor, of Goodyear, told a meeting of National Industrial Conference Board, Inc., that the rubber industry will continue to grow in rubber consumption, employment, payroll, and consumer service.

Harvey S. Firestone, Jr., chairman of the Firestone Tire & Rubber Co., predicted a substantial rise in civilian demand for replacement truck tires in the next several months.

The first "Natural Rubber Quality and Purchasing Seminar" in Akron, O., conducted by RMA emphasized that the consuming industry in this country intends to get what it pays for in natural rubber quality to a greater extent than ever before.

A new wage and working conditions contract between Goodrich and the United Rubber Workers of America, CIO, was finally agreed upon on August 29, and a strike which began August 18 at the Akron plants of the company ended.

Because of the rejection by the local URWA unions at Akron and Pottstown, Pa., the new master contract between Firestone and the URWA will have to be reopened.

The URWA at its national convention in Asbury Park, N. J., took steps to prevent unauthorized work stoppages by some of its local unions and approved several resolutions including those calling for increased company-paid pension, insurance, disability, and sick leave benefits.

Washington Report by Arthur J. Kraft

GR-S Price Likely to Remain at 23¢; Butadiene Now 18¢

On admittedly inconclusive evidence, it can probably be said with a fair amount of assurance that the Reconstruction Finance Corp., will continue its current selling price for GR-S at 23¢ a pound for at least several months more and quite possibly as long as hope remains for adoption of a program for disposing of the synthetic rubber plants to private owners.

No Change in GR-S Price Seen

We have the firm assurances of top RFC rubber officials that no price increase is in prospect; that any change, as long as the government is operating the plants, would be downward. The reason is that the current selling price, 23¢ a pound, is proving extremely profitable, particularly when it is considered that RFC still professes, at least for public consumption, to be following a policy of "no profit, no loss" in rubber. RFC officials confirm that they expect to net close to $30 million in profit in the fiscal year ending next June 30 on sales of synthetic rubber, a year that should see about 600,000 long tons of GR-S sold at some $172 million. Even after figuring corporate income and excess profits taxes (which RFC doesn't pay), the return is still good in comparison to most private industries.

RFC's new rubber director, E. D. Kelly, goes even further, having publicly stated recently that the 23¢ price being charged by RFC is a "private industry price" and that should the plants be turned over to private companies, no price increase should be necessary to assure profitable operation.

Whether RFC maintains the present selling price or lowers it apparently depends on one basic fact: whether it wishes to make a very good profit record, or will be content to eschew high profits in favor of giving the consumers a lower priced rubber. Recent evidence seems to point to the former as the likely policy to be pursued for at least several months and possibly until Congress decides the disposal issue sometime next spring or summer.

At least several reasons can be readily summoned to support the opinion that no price cut is on the horizon:

1. Perhaps the most important is that a good profit record is what RFC is deliberately out for, recognizing it as a help to its current efforts to work out an acceptable plant disposal program. A demonstration that the plants are sure money-earners would help overcome the reluctance of private industry to invest their stockholders' money in the plants.

By the same token, it would strengthen RFC's bargaining position in demanding a good price for the plants. If RFC can make a good profit this year and then sell the plants for fairly high prices, the American public, which put up the money to build them originally, could have little cause to complain about turning them over to private industry. RFC could tell Congress and the people that the public investment had been returned almost dollar-for-dollar and, perhaps fully, by profits accumulated over the past few years and purchase price for the plants.

There is little question that RFC will be called upon to make such a case, in view of the skepticism voiced by some Congressmen in the past, notably Lyndon Johnson, the Texas Democrat now chairman of both the Senate Armed Services preparedness and rubber subcommittees, of previous "disposal" or leasing schemes advanced by the rubber companies. Senator Johnson, while a member of the lower house four years ago, characterized one such plan as a "giveaway program," and he can be trusted to watch that the public's investment is given proper consideration in any disposal program advanced by RFC next year.

(At the moment, unconfirmed rumor has it that: (1) the rubber companies appear willing to pay well for the plants) boding well for getting a disposal program developed, and (2) several leasing approaches have been made to RFC by rubber companies which fall far short of these hopes. It is possible, but unlikely, that both could be true. The disposal discussions with RFC, however, are still in a preliminary stage; so it may be too early to tell which way the wind is blowing.)

Returning to the earlier part of this argument, that a good profit record will help overcome industry's reluctance to buy the plants, it should be noted that there is a considerable body of industry opinion that the 23¢ price is not a "private industry price." Rising raw material costs and the assumption of selling expense and tax burdens which RFC escapes would require that the price of GR-S be raised at least several cents a pound to make operation of the plants profitable to private owners.

If this belief is true, RFC would be cutting the ground from under its prospects for disposing of the plants at high prices if it lowered the selling price of GR-S. It would pose a difficult handicap to any private buyer, for he would be following a government price cutting move with a sharp price increase. While a government price cut might result in larger sales of GR-S, any sudden jumping of the price could well lose not only

the gain in sales, but more of the market to natural rubber, if the latter remains competitively priced. Faced with the prospect of a shrunken and more uncertain market for GR-S, potential private buyers might well go home and let the government keep the plants. Since it is largely the same companies which consume GR-S that are likely to be among the potential buyers of the plants which produce it, they couldn't lose by letting the government continue operation and selling the product at a price lower than the consuming companies could afford to produce it.

2. Another reason pointing against a price cut is the government's concern with maintaining economic (and, thus, political) stability in the Far East, where most of the natural rubber is produced. The ever-sensitive rubber market would almost certainly go into a tailspin, even if only temporary, if the price of its chief competitor were lowered. Although this concern is the State Department's, RFC officials are well aware that they cannot ignore the political implications of their business decisions. In this case, they happen to be in agreement with the State Department that a price cut would upset the rubber market overseas. This factor will be considered by RFC, but will not be the decisive factor in its price thinking.

Butadiene Price Set at 18¢

Into the picture drawn above must be fitted a recent concrete step by RFC, the decision to sell petroleum butadiene, a chief raw material for GR-S, on the open market at 18¢ a pound, far above the going market price for privately produced butadiene. Despite the fact that RFC produces about 90% of the nation's butadiene, the agency disclaims any intention of trying to establish a commercial market for the material. The move was initiated on September 1 with only two purposes in mind, RFC officials declare. One was to avert any severe cutback in petroleum butadiene output, which might result because of the shrunken requirements of the RFC copolymer plants. GR-S output has dropped over the past year from a monthly average of some 55,000 to 60,000 tons to the current level of slightly under 50,000 tons and is expected to level off at nearer 45,000 tons this fall.

Another reason for establishing the RFC selling price some 5¢ higher than the price at which most privately produced butadiene is moving (chiefly to manufacturers of nylon and of rubber-based paints and rubber-coated wallpaper), these officials say, is to stimulate private expansion of butadiene facilities. The latter would seem to imply that RFC intended to establish the commercial market price at or near 18¢, but this conclusion is not necessarily valid. RFC says it set its price deliberately well above the going market price so as to avoid any criticism that it was trying to compete with privately produced butadiene. New production could come into the picture without fear of being foreclosed of a market by cheap government material.

If this is the impression and effect that RFC wishes to produce, it is hard to see how it can expect to sell much butadiene. It can't very well offer to sell at a noncompetitive price and expect to find many buyers. It would eventually, therefore, have to cut petroleum butadiene output to fit the demands of its GR-S plants.

It seems to this reporter, and the impression is confirmed by several other observers, that the following rationale constitutes the real purpose of the RFC move: The commercial market price for petroleum butadiene, about 10¢ a pound, is the price of long-term contracts written several years ago. Were these renegotiated today, the price would be raised at least by several cents a pound. Some believe that the petroleum industry in a matter of a very few years will demand far higher prices for butylenes, which are in tight supply. It has other growing markets for butylenes, the basic material for butadiene. Aviation alkylate for high octane aviation fuel is the chief market, aside from synthetic rubber. Whether RFC professes such an intention or not, it is following the forecasted upward trend in butadiene prices by establishing a selling price of 18¢ a pound for government output.

A second part of this rationale is that RFC is confronted with the same sort of problem as it has with its copolymer plants, in attracting good offers to buy its butadiene plants. If it can establish an 18¢ market for butadiene, this problem should be largely overcome. The rubber facilities will still be the largest consumers of butadiene, and the price of GR-S would have to go up if private copolymer plant operators had to pay 18¢ for their butadiene. The expectation that this might occur may be another reason why RFC would not cut its selling price for GR-S as long as the chances of getting through a disposal program are alive. If the disposal efforts fail, no harm is done, since RFC makes all its own butadiene at a cost well under 18¢ and doesn't buy any.

It should be noted that while RFC enjoys integrated production of butadiene and GR-S, the Steelman Report, which still guides disposal policy to a large extent, specifically recommended against common ownership by private companies of butadiene and copolymer facilities, except in extraordinary circumstances where the President feels common ownership may be justified. With disposal, therefore, the purchasers of RFC butadiene facilities would have to price their material to make a profit. The 18¢ price may be excessive, even for a private operator; at least, that is what RFC officials contend. Others claim it is not excessive and may soon turn out to be too low. Only time can settle this question, but even granting RFC's contention that it is overpricing butadiene by a wide margin at the present, it is hard to escape the conclusion that a major purpose of this overpricing is to whet interest among prospective purchasers of the plants.

Despite RFC's sometimes qualified and coy professions to the contrary, it seems that RFC officials rather expect the price of GR-S to go up once the plants are out of the government's hands. Whether the price does go up or not, RFC is not concerned with this future problem. The agency's immediate problem and only real concern are with the present, and that is to induce private capital to put a healthy chunk of cash on the line while putting the government out of the synthetic rubber business. Meanwhile it looks like RFC is wooing those private investors by producing temptingly handsome profits on its own books.

Synthetic Plants To Be Reappraised; GR-S Output Cut

RFC announced September 15 that it will hire an outside engineering firm to make an up-to-date appraisal of the "present value" of the synthetic rubber facilities now owned by that agency.

Plant Appraisal Planned

The appraisal will be undertaken as part of the development of a plan for the disposal of the 26 government-owned plants. The new appraisal was recommended to RFC by representatives of some of the private companies currently operating the facilities under contract with the agency. These companies are being consulted by RFC on developing the disposal plan report due to be submitted to the President by March 1.

On September 15, RFC's Special Deputy for Rubber Facilities Disposal, Morton E. Yohalem, sent letters to ten prominent engineering firms asking them to consult with him on the specific scope and method of the projected appraisal. Once the specifications for the job are drawn up, Mr. Yohalem intends to seek bids for making the appraisal from any and all engineering firms interested in undertaking the job.

RFC suggested that engineering firms interested in submitting bids on the project communicate with Mr. Yohalem.

He was to meet with the industry representatives for further discussion of a disposal program late in September, before the appraisal actually gets underway. More frequent meetings are anticipated in the time remaining before the deadline for submitting the plant to the President.

Mr. Yohalem has been going into the background of the synthetic rubber industry, including Congressional legislation and hearings relating to it, rather exhaustively in preparation for the actual task of framing a disposal plan. He also attended the August London meeting of the International Rubber Study Group subcommittee which discussed the possibility of stabilizing the rubber market.

September GR-S Output Cut

RFC cut its overall production of GR-S in September, but produced more LTP GR-S types than in August. Scheduled for September was a production of 45,300 long tons of GR-S, including 26,400 tons of cold rubber. August production had been scheduled at 47,000 tons, including 24,000 tons of LTP GR-S. Actual sales in August as reported by RFC, amounted to 49,347 tons, including 24,611 tons of LTP GR-S. It appears likely that production in the final quarter of this year will average closer to 45,000 tons a month than 50,000 tons.

August sales also included 9,050 tons of black masterbatch, 4,479 tons of oil masterbatch, and 1,416 tons of oil-black masterbatch—the figures given as gross tons including GR-S and the oil and/or carbon black mixed with the rubber. GR-S latex sales amounted to 2,995 tons; while butyl rubber sales were at 4,294 tons.

The scheduled output for September included a far smaller amount of the masterbatch types, a step dictated by two considerations. One is that RFC has heavy inventories of masterbatch types, and plans—by cutting September output of these types—to bring the inventories down to a more balanced position. The other consideration is scheduling production to offset losses at two struck plants, which have been producing 122°F. GR-S exclusively. RFC officials believe that actual

sales of masterbatch types in September will about match the August sales, with more coming from inventory, rather than directly from current production. The September production schedules called for making 5,280 tons of black masterbatch, 2,310 tons of oil masterbatch, and 730 tons of oil-black masterbatch. Also scheduled for production were 3,617 tons of GR-S latex and 5,500 tons of butyl.

The September schedule figures given above take into account the impact of losses due to strikes at the Port Neches, Tex., copolymer plant operated by United States Rubber Co., and the Lake Charles, La., copolymer plant operated by Firestone. The Port Neches facility was shut down by a strike on August 26 and reopened on September 16 after the AFL Machinists Union withdrew its picket line. The Lake Charles facility was still struck in mid-September; it has been shut down since the twentieth of August.

RFC shut down the last remaining units of its alcohol butadiene facilities on September 1. It now has in operation only eight butadiene plants, all operating on petroleum raw material. The two alcohol butadiene plants, at Kobuta, Pa., and Louisville, Ky., were placed in standby status, to be readied for resumption of production should the need arise.

Exports of GR-S, which got off to a very slow start early this year, have been running at about 4,000 tons a month recently. In view of the dollar shortage overseas, such exports are not likely to average any higher in the foreseeable future. Butyl exports are expected to start toward the end of this year, when letters of credit are established. European interest in American butyl rubber seems stronger than in GR-S, for reasons of price and technology.

FTC Cites Four Heel and Sole Makers; Dismisses Youngs Rubber Complaint

The Federal Trade Commission, September 22, announced complaints of price discrimination in the sale of rubber heels, soles, and other products used in the shoe repair industry, against American Biltrite Rubber Co., B. F. Goodrich Co., Goodyear Tire & Rubber Co., and O'Sullivan Rubber Corp.

Type of Price Discrimination

These companies, FTC alleges, discriminate in price by selling their shoe products to some of their shoe finder customers at higher prices than they sell such products of like grade and quality to other of their shoe finder customers. These discriminations in price, the FTC said, are effected pursuant to respondents' cumulative volume discount plans whereby discounts, rebates, or allowances are granted from net selling prices based upon the customer's cumulative total of purchases of shoe products during one year. The net effect of this cumulative volume discount plans is to reduce substantially the prices charged favored customers over other customers, the Commission averred.

According to the complaints, the cumulative volume discounts range from none for purchases of less than $3,000 to 5% for purchases in excess of $35,000 by Biltrite; from none for purchases of less than $499 to 10% for purchases of $5,000 and over yearly by Goodrich; from none for purchases of less than $5,000 to 6½% for purchases of $100,000 and over yearly, for Goodyear; and from none for purchases of less than $3,000 to 17½% for purchases of $400,000 and over, yearly, for O'Sullivan. These discounts are in addition to the regular trade discount.

The price discriminations are alleged to be in violation of section 2a of the Clayton Anti-Trust Act, as amended by the Robinson-Patman Act. The effect, of these discriminations the complaints charge, may be to lessen competition substantially or tend to reate a monopoly in the lines of commerce in which respondents and their customers are respectively engaged; or to injure, destroy, or prevent competition with respondents or with customers who receive the benefits of the discriminatory prices.

The companies were given 20 days in which to answer the complaints, and hearings for the various companies were scheduled for November.

Youngs Complaint Dismissed

FTC reported on September 1 that it has dismissed without prejudice its complaints charging Youngs Rubber Corp., 145 Hudson St., and Julius Schmid, Inc., 423 W. 55th St., both of New York, N. Y., manufacturers and distributors of rubber prophylactics, with violation of section 3 of the Clayton Anti-Trust Act, which prohibits the practice of negotiating exclusive dealing contracts where the effect may be to lessen competition substantially or tend to create a monopoly in any line of commerce.

The Commission said that the allegations of the complaint "have not been sustained by the greater weight of the evidence thereon." The complaints were dismissed without prejudice to the right of the Commission to institute new proceedings against the respondents or to take such further action as warranted.

Tire Discount Rule Hearing

The FTC's contested tire discount limitation ruling will be back in the news again this month, with argument scheduled for October 13 in U. S. District Court in Washington on company and government motions.

The quantity limit rule, placing a ceiling of a single carload shipment for purposes of manufacturer discounts to purchasers of automotive tires and tubes, was originally set to take effect last April 7. Motions to nullify this ruling, filed in federal court by 20 companies, including manufacturers and some larger tire dealers, have put off the effective date indefinitely.

Up for initial argument this month are the company motions and a government motion to dismiss the company motions on the grounds that they are premature and presented to the wrong forum for adjudication. The government motion is based on the contention that a ruling cannot be contested as harmful to the companies involved before it actually is put into effect. The injury must derive from experience in operating under the ruling, the government motion declares. The government also contends that statutory enforcement procedures provide adequate remedy for testing the fairness of the ruling and should be used by the companies before going to court.

GSA Rubber Rotation Program

The Emergency Procurement Service, the branch of the General Services Administration which manages and purchases rubber for the strategic stockpile, sent its final recommendations to GSA Administrator Larson on September 18, covering the long-range natural rubber stockpile rotation program.

The recommendations, which have not been made public as yet, call for sharp modifications from the type of rotation pursued during the period of exclusive government importing and purchasing, which ran from January, 1951 to June 30, 1952. It is understood that the new program provides for government selling and purchasing both through dealers and directly with manufacturers—the latter is optional at all times for those manufacturers with the facilities (chiefly foreign buyers of their own overseas) to deal directly with GSA.

The program was carefully worked out over the past four months by EPS officials in consultation with the trade and manufacturers and is believed to have the agreement of all three groups. The suggestions that some part of the rotation transactions be made in direct dealing between manufacturers and the government came from GSA. Such transactions would lower handling costs for the government and the manufacturers since no middleman commission would be involved in sales from the stockpile to manufacturers and replacement of the rubber in the stockpile by the manufacturers. Only a few manufacturers, however, though they are large consumers of rubber, are expected to deal directly with GSA, and they are not expected to deal exclusively without the services of the dealer trade in buying from and replacing to the stockpile.

Rotation has been progressing in a small way since free trading was restored in natural rubber on July 1. GSA purchased 855 tons of natural rubber for stockpile rotation purposes during September. Its sales from the stockpile require replacement within 30 days.

AEC Selects Goodyear for New Ohio Plant

The Atomic Energy Commission announced in Washington on September 18 the selection of the Goodyear Tire & Rubber Co. as operating contractor for its Uranium-235 production plant soon to be built in Pike County, O., between Portsmouth and Chillicothe.

When the $1,219,000,000 facility is completed some four years hence, Goodyear will be the principal employer there with a permanent working force of about 4,000 persons. Individual units of the gaseous diffusion plant will be put into operation as they are completed. All operating employes will undergo an extensive training program so that some hiring of permanent personnel will probably begin early next year, it was said.

In assuming this operation, Goodyear officials will work closely with Union Carbide & Carbon Corp., operating contractor for the gaseous diffusion plants at Oak Ridge, Tenn., and Paducah, Ky. Carbide also will assist in the training of key personnel employed by Goodyear.

The Commission's selection of Goodyear was the result of many months of work by the AEC staff. A large number of the

nation's major industrial concerns with experience in running plants requiring continuous operations was canvassed to determine their interest and their capability to operate this facility.

M. W. Boyer, AEC general manager, said the Commission appreciated the cooperation of all the companies with which AEC held discussions prior to selecting Goodyear as operator.

In Akron, key management assignments of the Goodyear Atomic Corp., subsidiary of the Goodyear Tire & Rubber Co., which will operate the new atomic energy installation, were announced by Goodyear president, E. J. Thomas. The assignments follow: Albert J. Gracia, manager of operations; James A. Merrill, manager of laboratories; D. H. Francis, manager of development engineering; George H. Reynolds, manager of production; W. A. Brown, staff engineering and maintenance; Hugh C. Hilliard, industrial relations; H. H. Kenny, finance; and I. S. Gharky, purchasing and materials.

Gracia, prior to his new assignment, was assistant manager of research and development, reporting directly to R. P. Dinsmore, vice president in charge of these activities.

Merrill has held the post of assistant manager of research at Goodyear. In World War II he won the War Production Board Citation of Individual Merit for his work in developing an effective barrier, resistant to aromatic fuels, for use in bullet-sealing cells for fighter planes.

D. H. Francis is at present manager of the GR-S plant at Houston, Tex. George H. Reynolds is in charge of production at the company's subsidiary, Pathfinder Chemical Corp., Niagara Falls, N. Y., and vinyl film and flooring manufacture at Akron.

W. A. Brown is in charge of all work on maintenance analysis in Akron. Hilliard is assistant factory personnel manager at Akron; while Kenny is works auditor for Goodyear Synthetic Rubber Corp. Gharky is purchasing agent for the parent company's Australian operations.

Goodyear President Thomas explained to employes of the company in announcing this new activity that the reasons for undertaking the new assignment were as follows: (1) It is the duty of a company such as Goodyear to take on such an obligation in the interest of the defense needs of the nation. (2) An aggressive company should be allied with this important development. (3) It is a good thing for an organization to accept such a challenge.

DPA Tax Certificates

The Defense Production Administration granted certificates of necessity for rapid tax amortization to the following companies in the rubber, plastics, and associated industries during the period August 14 to September 10:

Monsanto Chemical Co., Everett, Mass., facilities for phthalate esters; the amount certified was $2,207,800, and rapid tax amortization was permitted on 45% of this amount; also, at St. Louis, Mo., tricresyl phosphate, $780,000, at 45%.

General Cable Corp., Perth Amboy, N. J., cable for military use, $2,350,000, at 40%.

Allied Chemical & Dye Corp., Philadelphia, Pa., phthalate esters, $318,400, at 45%.

Goodyear Aircraft Corp., Akron, aircraft parts, $149,464, at 65%. Goodyear Tire & Rubber Co., Akron, ordnance, $1,236,775, at 55%.

Commercial Solvents Corp., Terre Haute, Ind., tributyl phosphate, $232,900, at 45%.

B. F. Goodrich Chemical Co., Louisville, Ky., nitrile synthetic rubber, $163,000, at 65%.

United States Rubber Co., Chicopee Falls, Mass., military truck tires, $27,610, at 25%; at Fort Wayne, Ind., abrasive products, $347,578 at 65%.

Industrial Tape Corp., Elkhart, Ind., industrial pressure-sensitive tape, $3,272,330, at 65%.

Rubber Road Film Released

The Natural Rubber Bureau now has available for release a new motion picture film on the progress of rubber roads up to the present time. The film, "Stretching Highway Dollars with Rubber Roads," is beamed primarily at highway engineers, public works officials and contractors engaged in the road construction business.

The Bureau unveiled the 35-minute film at a special showing to a small group of invited guests on September 15 in the projection room of the Washington offices of the Motion Picture Association of America. Copies of the film, which is in black and white, are available for loan to engineering meetings and for exhibition for other groups, without charge. The film, produced for the Bureau by United World Films, a subsidiary of Universal Pictures Corp., is available from the Bureau in 16 or 35 mm. sizes.

Appearing in the film are members of the Bureau's staff, as well as several city and state public works officials and a private contractor. Most of the narration is by Harry K. Fisher, consulting engineer to the Bureau and chief of its rubber roads laboratory in nearby Rosslyn, Va.

Described in the film, by word and picture, are tests performed in the Bureau's laboratory and actual roads laid in Holland, the United States, and Canada, utilizing test strips of natural, synthetic, and reclaimed rubber-asphalt pavement. The film shows how the rubber compound is added to the asphalt mix, and how it is spread over the roadbed. It notes that neither operation requires special equipment not already in general use for asphalt paving which contains no rubber.

The film expresses the opinion that rubber roads, on the basis of the limited data available from the test strips laid to date promise to reduce the cost of upkeep and repair, because of their ability to withstand the rigors of heavy traffic and variable weather better than ordinary asphalt roads. The data adduced by highway engineers on test strips laid over the past four years in 18 states and the District of Columbia and Canada already point to such economies, according to the Bureau.

The Natural Rubber Bureau is located at 1631 K Street, N.W., Washington, D. C.

Other National News

Goodrich Contract Settled; Firestone's Reopened; URWA Convention Held

The negotiations between The B. F. Goodrich Co. and representatives of the United Rubber Workers, CIO, finally resulted in an agreement on August 29, after a company-wide strike which began August 18. The agreement provides for an increase of 10¢ an hour, effective August 27, subject to approval of the Wage Stabilization Board.

Terms at Goodrich

Highlights of the new agreement also include a provision for a full union shop; an improved company security-union responsibility provision aimed at materially reducing illegal work stoppages; liberalized minimum incentive guarantees; minimum vacation payments; and improvements in service credit rules.

The new contract was approved by the Akron local union on August 30 and by five of the other seven local unions at Goodrich plants in various sections of the country at the same time. It took the company and union negotiators 12 weeks to reach agreement.

Akron Firestone Local Rejects Contract

In Akron the local URWA union refused in two voting sessions on September 1 and 8 to approve the new contract signed August 25 by the company and the international union. Main objection to acceptance of the new contract was the Akron local union members' objection to the company's right to discipline—even discharge—workers who engage in unauthorized work stoppage or slowdown.

On September 16 it was announced from the URWA convention in Asbury Park that top officials of the union would hold a special meeting to discuss the situation created by the Akron and the Pottstown Firestone local unions' rejection of the master contract. Members of the Firestone locals were to meet with the international union officials. It was suggested that the meeting might result in a decision to reopen the contract negotiations.

On September 22 it was announced from the convention that the policy committee of the union had ordered reopening of negotiations for a contract with Firestone.

URWA Convention Resolutions

The URWA at its seventeenth annual convention in Asbury Park last month approved a new preamble to its constitution pledging the union to strive for the faithful performance of contracts entered into in good faith. The new preamble was proposed by Union President L. S. Buckmaster, who said that the sooner the organization went on record, the sooner it would be able to show all members they have the responsibilty of living up to contracts.

Buckmaster said some local unions have

done a poor job of living up to agreements and that about a dozen of the 300 URWA local unions have been the chief violators. The action was an indication that URWA officers consider the job of eliminating unauthorized work stoppages should have top priority, especially since the major union goal of winning union shops with major producers had been reached.

Resolutions adopted by the convention called for continuation of federal rent control, repeal of the Taft-Hartley Act, increased social security payments, federal aid to education, higher minimum wages, uniform workmen's compensation, stronger health and safety regulations, national health insurance, and enactment of anti-lynching and anti-poll tax legislation.

Increased company-paid pension, insurance, disability, and sick leave benefits were asked for in other resolutions, as was the industry-wide establishment of a six-hour day and 30-hour week. Support of Governor Stevenson and the Democratic Party in the coming elections was voted.

A resolution calling for industry-wide bargaining, particularly among the Big Four rubber companies, was voted down, as was a resolution urging the abandonment of the piecework system in the industry.

Industry Outlook Good

Outlook of the rubber industry is envisioned as a continued growing and vigorously expanding economy, in consumption, employment, payroll, and consumer service, W. F. Bloor, economist and chief statistician of the Goodyear company, told a meeting of the National Industrial Conference Board, Inc., in New York on September 17.

Speaking on "Rubber as a Raw Material: Current Status and Short-Term Outlook" at the opening session of the Conference Board's three hundred and thirty-third meeting at the Waldorf-Astoria Hotel, Bloor based his prediction on the steady 50-year increase in demand for and use of rubber, new uses now being developed, and those yet unforeseeable.

He pointed out six factors in the tremendous growth of this country during the past 10 years and expectations for the next decade that also add up to ever-increasing rubber consumption and unit tire demand, which were: population, national income, passenger-car registration, truck registration, tractor registration, and new products.

"The world supply of new rubber (natural and synthetic) in 1952 and 1953 should be ample for both civilian requirements and defense needs," Bloor said. "The world supply and demand situation for 1952 is production of 1,650,000 long tons of natural rubber and 885,000 long tons of synthetic, or a total of 2,535,000 long tons against an estimated consumption of 2,285,000, the excess of which will be largely absorbed for stockpiling by our government and allies.

"The outlook for next year, 1953," he continued, "is still for an excess of supply of both natural and synthetic over world demand; however, this surplus is narrowing to where plans should be made now for additional synthetic plant capacity in this country.

"The fact that we are now comfortably situated so far as rubber supply is concerned should not divert our attention from the portents of the early future," he cautioned, recommending a three-point national rubber program involving new natural rubber plantings in the Western Hemisphere to create a living stockpile, increased synthetic capacity now, and creation of a synthetic buffer stockpile.

"Prices of natural rubber during the next year or so should be held within a reasonable range of synthetic rubber price, so long as we maintain a fairly full production of synthetic rubber between 800,000 and 1,000,000 tons," Bloor said, after reviewing the history of wide fluctuations in natural rubber prices.

Earlier he pointed out that, although the objective of the nation's strategic stockpiling of natural rubber has been largely attained, the government remains an important buyer in world markets, and it is not known how much buying or support has come from that source in recent months, or will come during the balance of this year and 1953.

Increased Truck Tire Demand Forecast

A substantial rise in civilian demand for replacement truck tires was foreseen by Harvey S. Firestone, Jr., chairman of the Firestone Tire & Rubber Co., in a statement issued September 1.

"The long period of slow replacement demand for truck tires is substantially over, and a marked recovery is anticipated in the next several months. For more than a year, the civilian replacement demand for truck tires has been substantially below normal, and a recovery of at least 35% from current levels is anticipated," Mr. Firestone declared.

Three developments were cited as reasons for the expected recovery in truck tire demand: (1) Truck operators' inventories of tires have been reduced to normal. (2) Dealer inventories are relatively low. (3) Activity in a number of industries that are large shippers by truck is again on the upgrade.

"Following Korea, truck operators purchased tires far in excess of normal requirements. This protective buying was stimulated by the fear of a tire shortage and the fear that war conditions would reduce the amount of natural rubber in truck tires which would reduce their recapping possibilities.

"Retail demand for passenger tires returned to normal in the first quarter, but truck tire demand lagged because the consumer overbuying of truck tires was much more extensive than was the case with passenger tires. For this reason, it has taken a longer time to work off the larger volume of consumer stocks accumulated in the post-Korean buying spree," it was said.

"Because of the slowdown in consumer buying of truck tires, dealers have followed a cautious policy on inventories. Present low dealer inventories are an element of strength in the forward picture and will need to be rebuilt as demand picks up.

"Another encouraging aspect in the outlook for civilian replacement demand for truck tires is the marked recovery that is now under way in many industries that suffered from the same post-Korean consumer overbuying that hit the tire industry. There are now signs of expanding economic activity in the home appliance, furniture, carpeting and textile industries. These industries are large shippers by truck. In addition, recovery in the automobile and steel industries should also add to the demand for truck tires," it was concluded.

Natural Rubber Quality under Fire at RMA Akron Seminar

The first of the six two-day "Natural Rubber Quality and Purchasing Seminars" being conducted by The Rubber Manufacturers Association, Inc., throughout the country during the next several months was held in Akron, September 15 and 16, and was attended by nearly 200 representatives from 50 companies in that area.

W. J. Sears, RMA vice president, opened the Akron meeting with a statement that in the years since World War II, the packers of natural rubber have faced competition from synthetic rubber, but they have made no improvement in their product.

"The American businessman cannot understand this method of operation," Sears stated in referring to producers and packers failing to improve the quality and the uniformity of their shipments.

"It is due to the ingenuity and resourcefulness of the rubber consumer throughout the world that makes possible the successful use of a large share of the producer's output," he added.

"Where is there another supplier who has continued in business with such customer relations?"

The emergence of many new middlemen whose primary interest is in short-term and speculative profits has brought emphasis on quantity rather than quality, it was said. Periods of excess demand and large differentials between grades created incentives to up grade, mix grades, and otherwise engage in unscrupulous practices, Sears said.

If more and more companies buying natural rubber insist upon their shipments being up to industry standards, they will force Far Eastern packers to meet these requirements. RMA contends that because many of the smaller firms lack adequate knowledge of quality, packing, and inspection procedures recommended by the RMA and the Rubber Trade Association of New York, these firms are paying millions of dollars more for their rubber than is warranted by the quality of the material delivered to them.

If these firms adopt the buying and inspection methods recommended during the RMA Seminar, their rubber shipments will be improved, Sears declared.

Rubber inspectors of major rubber companies who examined samples submitted by smaller companies cited a number of cases where consumers paid considerably more than they should have for their rubber. A rubber purchased as #3 RSS was actually about #5 grade. The company was given a 1.1¢ a pound allowance instead of the 3¢ a pound it was entitled to. In another case, a company purchased what was supposed to be #2 thick blanket crepe rubber when it was actually #4 grade. The purchaser paid about 3¾¢ a pound too much, it was said.

Others participating in the program in addition to Sears and Charles C. Miller, of the RMA Washington staff, were J. P. Seiberling, president, Seiberling Rubber Co.; E. A. Stevens, treasurer, B. F. Goodrich Co.; R. B. Bogardus, assistant manager of crude rubber buying, Goodyear Tire & Rubber Co.; Val Wulff, assistant rubber buyer, Firestone Tire & Rubber Co.; E. C. Schwab, director of rubber purchasing, U. S. Rubber Co.; Ralph Au, manager of rubber purchasing, Goodrich; and C. J. Zabik, director of crude rubber purchases, General Tire & Rubber Co.

Expand Gen-Tac Latex Production

Expanded facilities for the manufacture of Gen-Tac Latex have been announced by R. B. Wittenberg, manager of the chemical division, The General Tire & Rubber Co., Akron, O. The product, a vinyl pyridine latex, which enhances the adhesion of rubber to rayon or nylon, is finding use in rayon and nylon tires, V-belts, hose, conveyor belts, and inflatable products. Bonds made with Gen-Tac Latex are said to show improved fatigue resistance and fewer ply separations in service. Gen-Tac dips are also said to reduce curing blows, minimize pick down, reduce scrap fabric losses, improve dip processing, and lessen squeeze roll build-up.

Increasing Ko-Blend Output

General Tire through Wittenberg also reported expanded facilities for the production of Ko-Blend I.S., a latex compounded masterbatch of insoluble sulfur. The product is made by mixing a finely divided dispersion of insoluble sulfur in water with a low-viscosity GR-S type of latex. The mixture is coagulated and dried to give a material that is a dry crumb with particles of the sulfur uniformly distributed throughout the soft rubber mass.

Moran and Gehring Advanced

Robert Moran has been named manager, special-purpose tire department at General Tire; while David G. Gehring takes over replacement sales in industrial tires, formerly handled by Moran. Gehring will also continue to handle replacement sales of farm tractor and implement tires.

Moran joined General Tire's stock control department in 1936, was loaned to the War Production Board in 1945, returned to truck tire sales in 1946, and in 1947 was made manager, industrial tire sales.

Gehring came to General in 1931, moved to the sales department in 1938, was a territory manager from 1948 to 1950, when he was named Boston branch manager, and in 1951 became assistant manager of the commercial sales division.

Pike in New Post

The new manager of sales training for General Tire is Herbert E. Pike, formerly eastern division sales training manager. Pike joined the company's eastern division organization in 1946 and served several years as a territorial manager prior to taking this training post, with new headquarters in Akron.

Pike started with United States Rubber Co. in 1932. He next was a territorial sales representative for the Champion Spark Plug Co. from 1936 until joining General.

Pike, a member of the Society of Automotive Engineers, will direct the training program of General's field organization and will also assist with instruction for General's distributor retail selling crews.

Robert A. Badenhop, of Robert Badenhop Corp., New York, N. Y., has accepted the chairmanship of the Rubber Division in the 1952 Fund Raising Drive of the Travelers Aid Society of New York.

Goodyear Erecting New Building in Birmingham

Construction of a new district sales and warehouse building for the Goodyear Tire & Rubber Co. has started in Birmingham, Ala., according to J. W. Tulloss, district manager, who said the expansion is being made to serve better the customers and dealers in the Birmingham district area, which includes all of Alabama, middle Tennessee, and north Florida.

The new building, at S. 10th St. and Fifth Ave. S., about four blocks from the old location at 2100 Sixth Ave. S., will be one story in height and will have 40,000 square feet of floor space, of which 33,000 will be warehouse area, and the balance for air-conditioned offices. This building will be served by a spur of the "Frisco" railroad and will provide space for loading or unloading five railroad cars simultaneously. There are also to be five freight bays for trucks, and a paved parking area for automobiles.

Total cost of the land and building, it is estimated, will be $260,000.

Size of the plot is 190 by 400 feet, providing ample room to expand the building by 10,000 to 15,000 square feet whenever needed.

Automotive Products Personnel

Four personnel changes in the automotive products department of the Goodyear Tire & Rubber Co., Akron, O., have been announced by W. H. McKenzie, manager of the department.

F. C. Melby, automotive products representative in Detroit, has been named manager of the molded and extruded division at Goodyear's St. Marys, O., plant, replacing H. H. Nuernberg, resigned. Melby joined Goodyear in 1949 as a squadron trainee, was assigned to junior sales staff at St. Marys in 1949, next was sent to Detroit as sales engineer, automotive products, and was named automotive products representative in March, 1952.

W. L. Minor, automotive staffman, at St. Marys succeeds Melby in Detroit. Minor started with Goodyear in 1948 as a production squad trainee, and later made junior development engineer, was assigned to sales staff, St. Marys, in 1950, and appointed automotive products staffman in March, 1952.

R. B. Chapin, automotive products contact man in Detroit, assumes the duties as automotive products staffman at the St. Marys plant. Chapin has been assigned to automotive products sales positions for the past year.

T. F. Solon, Akron staff squadron trainee, was transferred to Detroit to replace Chapin as manufacturers contact man.

DOP Plant Completed

Monsanto Chemical Co. has completed construction of a dioctyl phthalate plant in Everett, Mass., it was announced by Charles H. Sommer, general manager of the company's Merrimac Division. Operation of the new plant "provides an eastern manufacturing supply base to meet growing demand for this important plasticizer, as well as the expanding needs of the company's operations," Sommer said.

Phthalic anhydride, the raw material for the DOP plant, is being manufactured in an adjoining unit by the Merrimac Division.

Research Project on Rubber Roads

A research project on rubber roads is being carried on by the Engineering Experiment Station of the University of Kentucky under grants from Firestone Tire & Rubber Co., Akron, O. Preliminary work on the project was begun last year, and the research contract has been extended four times. Tests are being conducted to determine how bituminous mixtures containing rubber would wear if used for surfacing roads, highways, and streets. In one of the tests aged samples of the rubberized paving materials are placed in a fatigue tester designed by the University. The tester is installed in a refrigerating unit, and the samples are stressed at varying temperatures to simulate pounding from cars and trucks.

Firestone Making Tank Parts

Firestone is becoming a principal manufacturer of vital steel and rubber parts for the Army's Patton T-48 medium tank. Parts made by the company include the 90-mm. tank cannon with its quick change barrel, the steel and rubber tracks, road wheels, track support rollers, mufflers, engine mount, and turret seal.

Sets Safety Record

A new work record in industrial safety of 5,300,000 accident-free hours has been set for the tire manufacturing industry by Firestone's Akron plants, according to J. E. Trainer, vice president in charge of production. The previous record was made last year by the company's Memphis, Tenn., tire plant, and was 4,397,000 hours. Some 14,000 men and women were employed in the Akron plants during the record breaking safety period which began June 27.

Off-Highway Tire Service

A paper on "Tire Life in Off-Highway Service" was presented by L. W. Fox, of Firestone, at the National Tractor Meeting of the Society of Automotive Engineers on September 8-11 at Milwaukee, Wis. This paper gave a practical consideration of the factors influencing the service life of off-highway tires, with emphasis on tire types and sizes.

World Bestos Division

Wm. J. Nanfeldt has been appointed general manager of Firestone's World Bestos Division to succeed Donald H. Spicer, resigned.

In other changes at the New Castle, Ind., plant, Wm. R. Rogge was promoted from manager of the replacement sales division to general sales manager. R. A. Riley, continues as comptroller, but with expanded responsibilities. L. G. Kersgard remains manager of special accounts.

Nanfeldt, a founder of World Bestos in New Haven, Conn., 30 years ago, who stayed with the company when purchased by Firestone in 1937, has advanced successively through research, engineering, production, and plant management. He moved to New Castle in 1946 when the business transfered from Paterson, N. J.

Rogge started with the Firestone subsidiary in 1948.

Riley was manager of sales accounting at the Fall River, Mass., Firestone Industrial Products plant, which he had joined in 1937, before becoming comptroller for World Bestos in 1942.

U. S. Rubber Footwear Plant for Puerto Rico

United States Rubber International Corp., New York, N. Y., last month concluded negotiations with the Puerto Rico Industrial Development Corp. for a new factory site and building in Bayamon, Puerto Rico, for the manufacture of a new type of canvas and rubber shoe.

The development corporation will provide U. S. Rubber International with a building of 23,000 square feet and a site of 4½ acres. Initial operation of the plant will be of pilot character.

Vote Common Stock Split

Stockholders of Boston Woven Hose & Rubber Co., Cambridge, Mass., at a special meeting September 2, at which about 78% of the outstanding shares were represented, voted to amend the company's Agreement of Association and Articles of Organization by changing the authorized common stock of the company from 86,000 shares without par value to 344,000 shares without par value.

It was further voted to distribute to stockholders of record at the close of business September 5, 1952, three additional shares of no-par common stock for each share of its then outstanding no-par common stock. The new certificates are being mailed stockholders by The National Shawmut Bank of Boston.

Add to Sales Staff

American Resinous and American Polymer corporations, both of Peabody, Mass., recently made two additions to their technical sales staff, Orville H. Heinicke and F. L. Sutton. The former will represent the two companies in Ohio, calling on customers in the paint, rubber, textile, chemical and other industries; while Mr. Sutton will cover Connecticut and Metropolitan New York.

Mr. Heinicke includes among his former employers Wright Aeronautical Corp., National Advisory Committee for Aeronautics, and Sealol Corp.

Mr. Sutton gained his experience in research, sales, and development with United States Rubber Co., Cordo Chemical Co., and R. T. Vanderbilt Co.

Quaker Rubber Story

Quaker Rubber Corp., Philadelphia, Pa., is written up in the September 15, issue of "The Royle Forum," published by John Royle & Sons, Paterson, N. J. The story covers the history of Quaker from its founding in 1885 by Charles A. Daniel to its present position as an important producer of industrial rubber goods.

Arthur D. Little, Inc., Cambridge, Mass., has opened an office to handle investigations in the Midwest and to facilitate relations with clients there. The new office, at Room 2074, Railway Exchange Bldg., St. Louis 1, Mo., is headed by John R. Kirkpatrick.

Harry L. Wright

FEMCO Expansion Plans

Falls Engineering & Machine Co., Cuyahoga Falls, O., manufacturer of V-belt molds, V-belt equipment, and special machinery for the rubber industry, is expanding production.

Harry L. Wright, president and owner of the 35-year-old firm which began business as a general machine shop, said the company has discontinued its mechanical mold department in order to expand its V-belt mold, V-belt equipment, and special machinery production.

William J. Hunt, formerly a partner in Falls Engineering, has established his own mechanical mold manufacturing business in Cuyahoga Falls and will service its former mechanical mold customers.

Space formerly devoted to mechanical molds in the Falls Engineering building is now being used principally for special machinery production and for engineering and development offices of Campbell Machinery Development Co., which designs all FEMCO-built machines. Headed by John F. Campbell, the development company had been at 2379 Front St., Cuyahoga Falls.

Over the past several years FEMCO as a manufacturer of V-belt molds supplied most of the rubber companies which make V-belts. The firm also has built up a successful line of more than 20 special machines, which serve 12 fields allied to the rubber industry, including companies which work with rubber and plastic floor tile, foam rubber, rubberized hair, fiber glass, wood fiber, rubber footwear, cork, cellulose sponge, rubber flat belts, V-belts, inner tubes, and rubber hose.

Special machinery in the FEMCO line includes collapsible V-belt molds, belt notching machines, expandable belt building drums, V-belt molders, measuring and matching machines, tile cutting and blocking machines, foam rubber cushion cutters and splitters, circulatory dust systems, and soapstone dusting machines.

Wright also announced the appointment of Louis P. Bokanyi, recently with William R. Thropp & Sons, Trenton, N. J., as sales manager of the company. Since 1937, Bokanyi has been associated with such firms as Timken, Hoover, Goodyear, and National Rubber Machinery.

James L. Hyatt, in charge of purchasing for Falls Engineering, and a director of the company, has also been named secretary of the firm, Wright added.

Du Pont Now Presents a Television Program

"Cavalcade of America," the radio program sponsored by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., for the past 18 years, is now on television in a new dramatic show produced in Hollywood. The new bi-weekly telecasts feature true stories of the achievements of the men and the women who have contributed to the American heritage. The premiere performance, seen in most localities on October 1, featured a performance of "Poor Richard," starring Cecil Kellaway, Dabbs Greer, and Leo Britt. The second program was "All's Well with Lydia," a drama of the War of Independence, starring Ruth Warrick and Reginald Denny.

Swan Succeeds Gay at RFC

The Research & Development Division, Office of Synthetic Rubber, Reconstruction Finance Corp., Washington 25, D. C., last month announced the following personnel changes:

Carl W. Gay has resigned as assistant chief of the Division to return to employment at The Goodyear Tire & Rubber Co.

Thomas H. Swan, head of the Polymer Research Section, has been promoted to Gay's position in the Research & Development Division.

Arthur L. Hollis is now chief of the new Polymer Science Branch, which combines the Polymer Research and the Polymer Development sections.

Alfred M. Anisman has been switched to Polymer Science from the Plant Operations Branch.

R. M. Clibourn, F. McClelland, and Maurice H. Whitlock have been transferred to the Applied Development Branch from Plant Operations.

New Lubricant Available

DuBois Co., Inc., Cincinnati, O., announced that both its Cincinnati and Los Angeles, Calif., plants are now set up to supply the new peptizing grade of Latex-Lube (Pigmented). According to Samuel J. Miller, the company's chemical director, this modified material for rubber surface lubrication is recommended particularly for high cold flow stocks and for any stock handling or piling operations where sticking is a problem. Latex-Lube (Pigmented) is essentially a non-saponaceous type of material, as contrasted with the firm's standard Latex-Lube GR.

Miller also announced the assignment of A. T. Peterson to assist in rubber industry service problems in the field. Operating out of the Cincinnati office, Peterson will be concerned primarily with plant applications of the Latex-Lube compounds.

B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, O., on September 1 opened a new field sales office in Suite #1736, 1339 Chestnut St., Philadelphia 7, Pa. This new office will be staffed by E. B. Osborne and R. L. Lundquist, handling sales and service on Geon polyvinyl materials, and P. C. Cramer, sales representative for Hycar American rubber.

RFC Simplifies Sales Procedure

A memorandum simplifying the sales and distribution system for synthetic rubber, and eliminating the cumbersome and time-consuming Purchase Request — Purchase Permit system previously used, was issued by the Sales Branch, Office of Synthetic Rubber, RFC, on August 25. The memorandum forms an amendment to the General Sales and Distribution Circular for Government Synthetic Rubbers (revised February 1, 1950) issued by RFC, and reads in part as follows:

"Effective with requests for the month of October, 1952, prospective purchasers of synthetic rubber shall employ (in lieu of the existing form of Purchase Request) the Purchase Order forms of such purchaser used in the normal conduct of his business, provided there shall by typed or stamped by the purchaser on the face thereof the following:

> "This Purchase Order is subject to the "General Sales and Distribution Circular" issued by Reconstruction Finance Corporation, as amended, including amendment dated August 25, 1952."

"Such Purchase Order shall always merely constitute advice (subject to this Memorandum) of the type and quantity of synthetic rubber requested, the destination, and the requested shipping dates, notwithstanding any further contents thereof. Separate Purchase Orders shall be submitted for each general category of synthetic rubber requested, i.e., GR-S, GR-S Latex, GR-I. All Purchase Orders must be mailed to the Reconstruction Finance Corporation, Office of Synthetic Rubber, Sales Division, 811 Vermont Avenue, N. W., Washington 25, D. C., *in sufficient time to reach this office not later than the twelfth day of the month preceding the month in which shipment of the rubber is desired.* All requested shipping dates on a particular Purchase Order must be confined to a single calendar month.

"Consumers who desire to purchase synthetic rubber produced by this Corporation shall purchase either directly from this Corporation or from a dealer who has purchased from this Corporation as principal. In the latter case the dealer shall submit his own Purchase Order to this Corporation.

"Purchase Permits will no longer be issued. Upon receipt of your Purchase Order, we shall forward a Shipping Order directly to the Distributing Agent scheduled to effect shipment of the synthetic rubber requested by the prospective purchaser. A copy of such Shipping Order will be forwarded to the prospective purchaser which shall merely constitute a courtesy acknowledgment of the Purchase Order and will indicate to the prospective purchaser the source from which the synthetic rubber is scheduled to be shipped. Each such Shipping Order shall be subject to this Memorandum which is hereby incorporated therein by reference.

"Separate Shipping Orders will be issued for each type of rubber and the quantity and price (Provisional) thereof, as well as the destination and desired shipping dates, will be indicated thereon. Shipping Orders of those accounts which have established credit will be perforated to indicate that the material may be shipped on a 30-day credit basis.

"Upon receipt by the prospective purchaser of a copy of said Shipping Order, he shall immediately forward to the Distributing Agent named in said Shipping Order, detailed routing instructions, together with (if credit has not been established) cash-equivalent funds covering the Provisional Price set forth in the Shipping Order and the Uniform Freight Charge.

"Upon receipt by the Distributing Agent of a Shipping Order, routing instructions, and funds (when credit has not been established), the Distributing Agent will endeavor to ship the quantity and type of synthetic rubber listed therein on the dates scheduled therein, but it is understood that neither RFC through said Distributing Agent, or otherwise, nor said Agent, shall have any obligation or liability for failure to ever ship or deliver all or any portion of the synthetic rubber listed in any Purchase Order or Shipping Order. In the event shipment is made on or after the shipping date set forth in the Shipping Order in the absence of receipt by said Distributing Agent of routing instructions, said Agent will ship the synthetic rubber by way of either rail, truck, water or combination thereof by he most economical route. However, neither this Corporation nor said Agent shall be liable for any loss, damage or delay which may result from the selection of a particular route or mode of transportation. In the absence of receipt by this Office of written notice from the prospective purchaser to cancel any undelivered quantity listed in a Purchase Order or Shipping Order, this Corporation shall have the right, (without obligation) to make deliveries thereof at any time.

"Upon delivery by this Corporation, through said Distributing Agent, of the synthetic rubber to the custody of the carrier at the producing plant or warehouse without notice to the prospective purchaser of any change in the Provisional Price set forth in the Shipping Order, and prior to receipt by the Washington Office of this Corporation of any written notice from the prospective purchaser to cancel, a sale of the quantity so delivered shall thereupon be consummated, and the purchaser shall pay therefor the said price as set forth in the particular Shipping Order under which such delivery is made, plus the Uniform Freight Charge.

"In the event this Corporation increases or decreases the Purchase Price beyond or below the Provisional Price set forth in a particular Shipping Order, notice thereof shall be given to a prospective purchaser, and no deliveries shall thereafter be made thereunder until written notice is received by the Washington Office of this Corporation that the prospective purchaser will pay the new price for any deliveries thereafter made by this Corporation thereunder."

To Distribute Teflon Belting

Voss Belting & Specialty Co., Chicago, Ill., has been appointed by E. I. du Pont de Nemours & Co., Inc., as the first distributor of conveyor belting made of Teflon coated glass fabrics. Voss is a manufacturer and distributor of specialized belts for many purposes, and a midwestern distributor of all types of belting. The Teflon belting is expected to be of great interest to manufacturers in many different industries because of its resistance to chemicals and both high and low temperatures, its non-sticking qualities, and its exceptional wear resistance.

Forms Foreign Department

Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., has organized a foreign department to direct all its overseas chemical sales operations. Headquarters will be in the Empire State Bldg., New York, N. Y.

Manager of the foreign department will be Robert Kirk, for the past six years export manager for the chemical division of McKesson & Robbins, Inc. He also brings to his new post experience in chemical process development gained during five years with Merck & Co., Inc.

Sales manager of the new department is David H. Hoyer, who has directed the export sales of agricultural chemicals for Pittsburgh Coke since 1948.

Among the products sold abroad by Pittsburgh Coke are coal chemicals, agricultural chemicals, plasticizers, dyes, activated carbons, and protective coatings.

Butyl Chloride Output Up

Carbide & Carbon Chemical Co., Division of Union Carbide & Carbon Corp., New York, N. Y., announced that it has tripled the production capacity for butyl chloride. Economies resulting from the expansion have made possible a price reduction of 6¢ a pound for the chemical, making it attractive for use as a butylating agent in organic synthesis. It can be used in the preparation of rubber chemicals, plasticizers, resin stabilizers, essential oils, pharmaceuticals, dyestuffs, oil additives, and corrosion inhibitors.

Witco Executive Changes

Witco Chemical Co., 295 Madison Ave., New York 17, N. Y., has announced that recent reorganization of the executive staff has resulted in the following appointments: William Wishnick to the position of assistant to the president; J. J. Tumpeer, to national asphalt sales manager; B. W. Lewis, to Midwest asphalt sales manager; J. A. Raggio, to eastern asphalt sales manager; W. F. Twombly, in charge of product development; J. H. Wishnick, to manager of Chicago and Lawrenceville plants; and Stanley Trimble to controller.

Thomas J. Starkie is now national chemical sales manager; E. F. Wagner, assistant national chemical sales manager; and C. A. Damen, assistant vice president in charge of the Washington office. M. A. Minnig is national sales manager of rubber chemicals, with H. Brubacker as assistant national sales manager of carbon black.

New United Carbon Plant

United Carbon Co., Inc., Charleston 27, W. Va., has completed its new Ivanhoe plant at United, La., for the manufacture of high abrasion furnace (HAF) black. This new plant incorporates the latest engineering and research designs in furnace black manufacture. The plant has a capacity of more than 30,000,000 pounds of black a year and is expected to aid materially in fulfilling the demand for HAF black, which is especially required for cold rubber.

AZO-ZZZ-55

zinc oxide

AZO ZZZ-55

Uniform particle size and absence of extreme "fines" assures good dispersion and easy processing.

AMERICAN ZINC SALES CO.

Distributors For

AMERICAN ZINC, LEAD & SMELTING CO.

COLUMBUS, O. CHICAGO

ST. LOUIS, MO. NEW YORK

Follo Returns to GAC

Increased production and contemplation of additional new business has resulted in the expansion of executive responsibilities at Goodyear Aircraft Corp., Akron, O., according to T. A. Knowles, vice president and general manager.

Val L. Follo, in charge of production of the U. S. Navy's Corsair fighter plane in GAC's Plant D during World War II, has been returned to the company as factory manager; while C. H. Zimmerman will guide increased and intensified production programs in the wheel and brake, rocket, and Wingfoot Lake divisions.

For Follo this assignment marks his return to GAC after six years with The Goodyear Tire & Rubber Co., during which time he was superintendent of the tire company's new plant at Uitenhage, South Africa and, since 1948, superintendent of Plant II tires at Akron. Follo joined the Goodyear organization in 1919 as a member of the tire company's new production control department. Six years later he was appointed general foreman of the department; in 1929, division superintendent of Goodyear Tire's new plant at Gadsden, Ala.; and in 1938, manager of the company's new plant at Norrkopping, Sweden. He joined Goodyear Aircraft in 1942 as production superintendent for the Corsair fighter program in Plant D and became manager of the giant plant two years later. Following the cessation of hostilities, Follo was appointed plant manager at Uitenhage.

Huffman Succeeds Follo

Marvin Huffman has been appointed acting superintendent of tire production in Goodyear's Plant Two, Akron, replacing Val Follo, now factory manager of Goodyear Aircraft Corp. Huffman, on special work since 1950, joined the company as a college trainee in 1940; he entered Goodyear Aircraft's standard practice department the following year and later became an industrial engineer there. Returning to the tire company in 1945 as a senior staffman in its standard practice department, Huffman was assigned special work in production in 1950.

Join Taylor Sales Staff

Taylor Instrument Cos., Rochester, N. Y., last month announced the placement of six additional industrial salesmen in various territories.

Bruce B. Greenfield and William B. Manning have joined the New York sales force; both men will work largely in Manhattan proper.

Philip F. Gilman, at Knoxville, Tenn., is working under the direction of the sales office in Atlanta, Ga. He is a former member of the company's application engineering department and has intimate knowledge of instruments and their applications, especially in the textile field.

Recently assigned to the Tulsa, Okla., sales organization is Byron W. Larsen, who will cover the Louisiana territory.

After a training course in Rochester, Bruce W. Wallace assumed his duties as an industrial salesman in the Chicago territory. He is a graduate electrical en- to joining Taylor.
period with Day & Zimmermann, Inc.,

National Chemical Show

The Seventh National Chemical Exposition, sponsored by the Chicago Section, American Chemical Society, was held at the Chicago Coliseum on September 9-13. The show comprised some 216 booths, at which more than 200 exhibitors displayed their latest developments in materials and equipment for the chemical field.

Exhibits of special interest were: American Instrument Co., testing instruments; Armour & Co., chemical division, plasticizers and latex stabilizers; Bemis Bros. Bag Co., polyethylene liners for packages; Commercial Solvents Corp., solvents for rubber and plastics; General Electric Co., silicone elastomers, releasing agents, and specialties; Minnesota Mining & Mfg. Co., fluorochemicals; Monsanto Chemical Co., chemicals and plastics; Precision Scientific Co., instruments; Saran Lined Pipe Co., plastic lined pipe, valves, and fittings; Tennessee Eastman Corp., plastics, plasticizers, and chemicals; United States Gasket Co., Teflon gaskets, tiling, tank linings, and filter sheets; U. S. Industrial Chemicals Co., resins and chemicals; and U. S. Stoneware Co., plastic tubing, gaskets, linings, coatings, and molded items.

Two symposia were presented at the Coliseum in conjunction with the Exposition. On September 9 six speakers participated in a symposium on "Looking Ahead with the Chemical Industry"; while on September 11 was held a symposium on 10 speakers on industrial application of atomic energy. One of the speakers at the first symposium was Waldo L. Semon, B. F. Goodrich Co., who discussed "The Rubber Industry."

In discussing the rubber industry and comparing natural and synthetic rubbers, Dr. Semon said, "It would be highly desirable if rubbers were available that did not possess the intrinsic defects of natural rubber. Here is where lies the real future for man-made rubber."

Dr. Semon listed 14 types of synthetic rubber so far developed, but pointed out that the field is still wide open.

"Rubber products are currently being demanded to operate all the way from liquid air temperatures to red heat," he said. An "inorganic rubber might be the answer, although it sometimes appears that what is needed is an elastomeric metal."

Painter and Hess Elected

Robert J. Painter and Raymond E. Hess have been elected executive secretary and associate executive secretary and editor-in-chief, respectively, of the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. The promotions, effective September 16, were announced by Harold L. Maxwell, of E. I. du Pont de Nemours & Co., Inc., and Society president. Mr. Painter, who replaced the late C. L. Warwick, was previously treasurer and assistant secretary of the Society; while Mr. Hess was formerly assistant executive secretary and editor.

Mr. Painter joined the ASTM staff in 1931 after having been with Bethlehem Steel Co. Mr. Hess after a short gineer and had industrial experience prior became a member of the ASTM staff in 1920.

Forms Export Subsidiaries

Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, O., has formed two new subsidiaries to handle its rapidly increasing volume of export sales.

The new concerns, both incorporated in Delaware, started their activities September 1. Diamond Alkali Inter-American Corp. is the sales outlet for Diamond chemicals in Latin America and other countries in the Western Hemisphere outside the United States; and Diamond Alkali International, Inc., will serve all other areas of the world.

Offices and facilities of both new companies are at 122 E. 42nd St., New York, N. Y.

S. S. Savage has been elected president of the new export companies.

Diamond Alkali operates 13 plants throughout the United States which produce organic and inorganic chemicals for agriculture and industry.

Mills, Kennady Branch Heads

Effective November 1, Earl J. Mills will become manager of the Chicago branch sales office of Diamond Alkali, succeeding the late Charles W. Klaus, and John W. Kennady will be manager of the southwest district sales office, with headquarters at Houston, Tex.

The Chicago office supervises Diamond sales activities in a nine-state area comprising Illinois, Indiana, Iowa, Michigan, Minnesota, Wisconsin, Nebraska, and the Dakotas. The southwest district embraces Texas, Oklahoma, and Kansas.

Mr. Mills is a veteran member of Diamond's sales department. Throughout his many years with the company in sales, service, and supervisory capacities, he has traveled the country extensively, covering the chemical and allied fields.

Mr. Kennady comes to the Diamond sales organization from Kolker Chemical Works, Inc., a Diamond subsidiary, which he has been serving as district manager at Kolker's Houston plant.

Wyandotte Advances Three

Michigan Alkali division, Wyandotte Chemical Corp., has announced the following promotions, effective January 1: M. J. Conway to manager of the central district; H. C. Brunner to manager—distributor sales; Bert McCord to sales representative, central district. These men will operate from the home office at Wyandotte, Mich.

Mr. Conway is assuming charge of the newly created central district covering Michigan, northern Ohio, northern Indiana, western Pennsylvania, western New York, and northern West Virginia. Manager of the Pittsburgh sales office since 1946, Mr. Conway has more than 28 years with Wyandotte.

Mr. Brunner manager of the Detroit office for the last six years, has been with Wyandotte since 1930. In his new position he will be charged with the administration of all distributor sales and will develop and execute promotional programs related to distributors.

Mr. McCord will assist Mr. Conway as sales representative in the central district. McCord was formerly manager of the Detroit sales office of the general chemical division of Allied Chemical & Dye Corp.

NEW SUN PROCESS AID IMPROVES QUALITY OF COLD GR-S TIRE TREADS

SUNDEX-41

1. **Helps prevent scorching during mixing, milling and extruding.**
2. **Aids dispersion of compounding ingredients.**
3. **Reduces power consumption.**
4. **Contributes to improved wear resistance and flex life of cured products.**
5. **Speeds processing of oil-extended GR-S polymers.**

THIS COUPON WILL BRING YOU COMPLETE DETAILS

Send for our special bulletin on Sundex-41. It contains detailed reports on laboratory-scale and factory-scale mixing and milling runs of cold-rubber stocks. Helpful data on recipes, order of mixing, processing procedures, and physical properties of cured and uncured specimens are included.

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SUN INDUSTRIAL PRODUCTS

SUN OIL COMPANY, PHILADELPHIA 3, PA.
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SUN OIL COMPANY, Dept. RW-10
Philadelphia 3, Pa.

Please send me a copy of your special bulletin on the new Sun rubber-process aid, Sundex-41.

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Company_____

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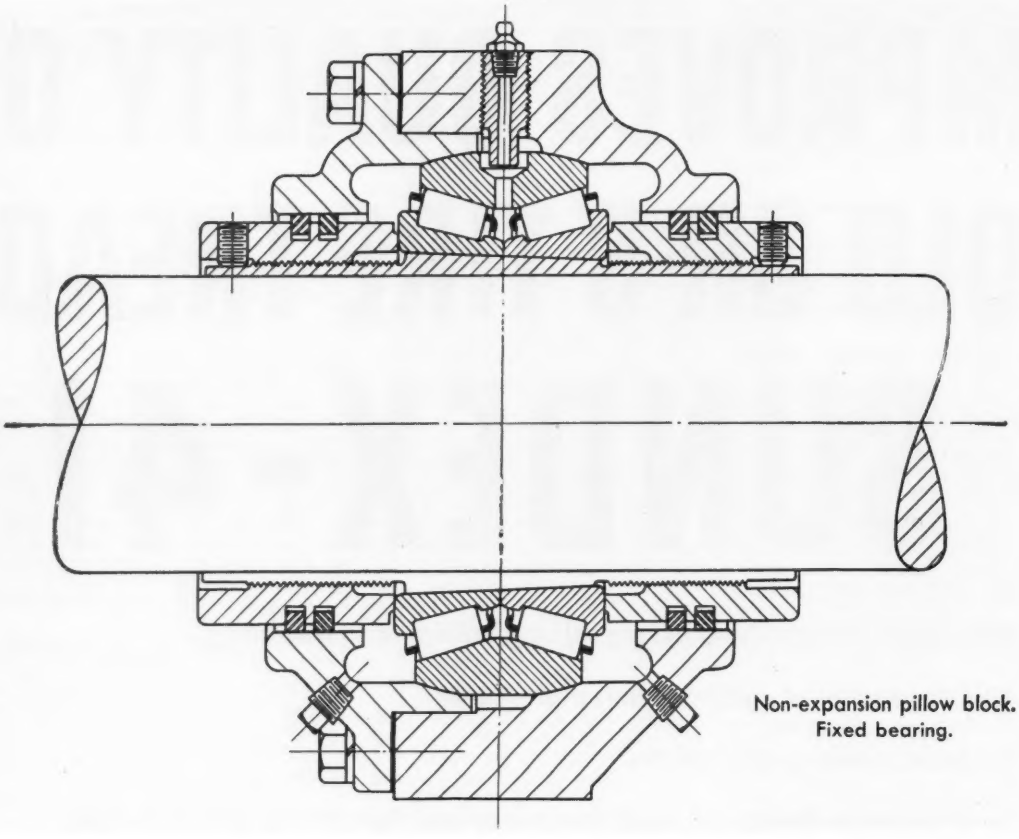
NEW TIMKEN® ROLLER



Non-expansion pillow block.
Fixed bearing.

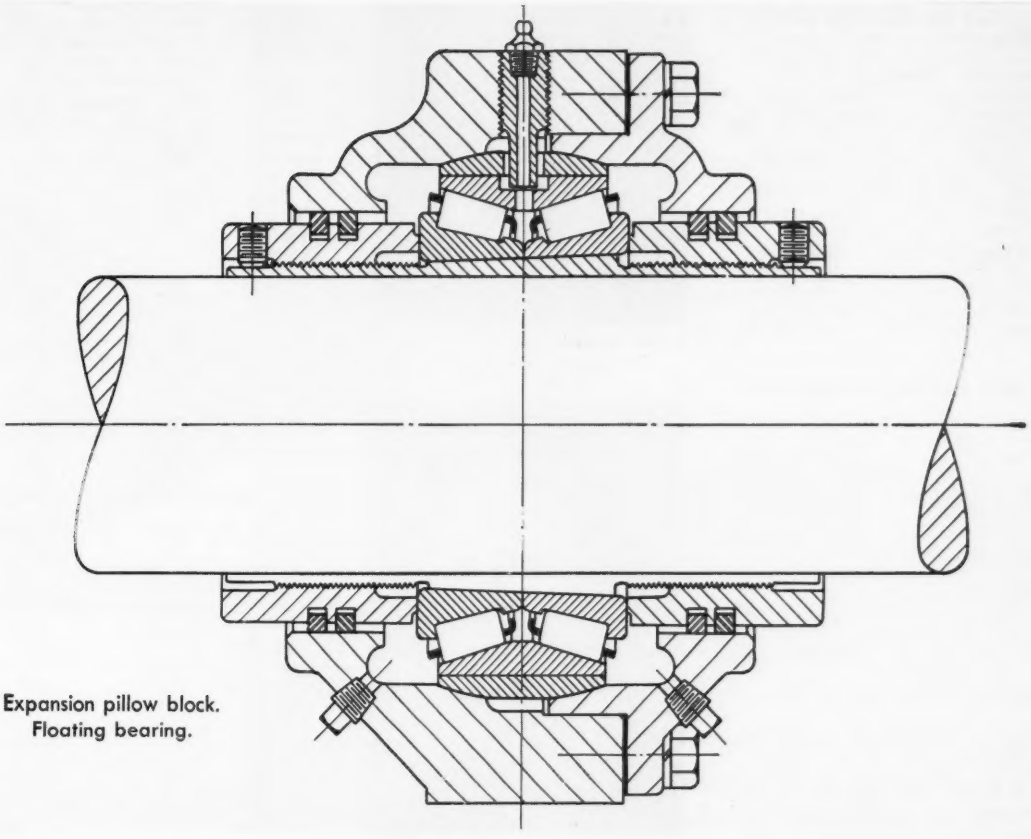
First application of new tapered makes new Dodge-Timken®

IT takes up less space. It weighs less. Yet the new Dodge-Timken® All-Steel pillow block has tremendous load-carrying capacity.

It's the result of the combined achievements of the Dodge Manufacturing Corporation, Mishawaka, Ind., and The Timken Roller Bearing Company and makes use of an entirely new Timken bearing. Never before has a self-aligning, non-adjustable tapered roller bearing with tapered bore been used in pillow blocks.

Being of all-steel construction, this new Dodge-Timken pillow block is more compact and fills a real need where space is a factor. It is available in both expansion and non-expansion designs. And it incorporates all the advantages of Timken tapered roller bearings.

BEARING PILLOW BLOCK



Expansion pillow block.
Floating bearing.

bore TIMKEN® bearing pillow block more compact

Because of their tapered construction, Timken bearings take radial and thrust loads in any combination. Line contact between rollers and races gives Timken bearings load-carrying capacity to spare. Timken bearings are made of the finest steel ever developed for tapered roller bearings—Timken fine alloy steel—and under normal conditions will last the life of the machinery with which the pillow blocks are used.

When you install new Dodge-Timken pillow blocks, you can expect dependable performance because the bearings are the best. No other bearing can give you all the advantages you get with Timken bearings. Specify them for all your other machinery, too. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN
TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST ◫ LOADS OR ANY COMBINATION ✳

Cabot Enters Clay Field

Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass., has announced a new step in the mineral pigment field with the production of air-floated and water-washed Georgia kaolin clay. Through the acquisition of the Georgia Pigment Co., Sandersville, Ga., Cabot is now offering several quality grades of clay in commercial quantities for use in the paper and ceramic industries. Plans for the future include expansion of the Georgia company by Cabot to provide a complete range of high-quality clays for use in the rubber industry. To this end Cabot has already begun installation of improvements in the manufacturing facilities of the company and is establishing a new technical control laboratory there.

The Georgia Pigment Co. will retain its name in the new Cabot operations. William W. Kingman and J. T. Houk will continue on as general manager and sales manager, respectively, of the Georgia firm.

Collyer and Barlow Transferred

Godfrey L. Cabot, Inc., on September 8 announced two major changes in the executive branch of its technical department.

Harry J. Collyer, technical manager of Cabot Carbon, Ltd., English subsidiary company, has returned to Boston headquarters to become manager of technical service under Fred H. Amon, technical director of the Cabot companies.

Fred W. Barlow, formerly in charge of rubber and plastics testing at the Boston rubber laboratory and more recently of the Texas research and development laboratories, succeeds Mr. Collyer in England.

As manager of technical service for the parent company, Mr. Collyer will be concerned with the maintenance of quality control at all Cabot plants and with service to all customers on technical problems. He will be directly responsible for the publication of Cabot technical literature.

As technical manager of Cabot Carbon, Ltd., Ellesmere Port, near Liverpool, England, Mr. Barlow will be responsible for the continuance of rigid product quality control through constant, complete laboratory testing. He will be in charge of sales technical service in Great Britain.

Fabian Bachrach

Harry J. Collyer

Smith Studio

Fred W. Barlow

Review Cold Rubber Production

A review of five years of cold rubber production was recently given by Col. C. M. Hulings, operating vice president of Copolymer Corp., Baton Rouge, La. Copolymer was one of the first synthetic rubber plants to produce cold rubber and the first integrated plant to combine butadiene and styrene in one continuous operation for making synthetic rubber. Of the more than $40,000,000 spent on research by the government since the start of the entire synthetic rubber program, the best development resulting from this research is cold rubber, Colonel Hulings said. On the proved increase mileage given by cold rubber over standard GR-S, American motorists saved more than $347,000,000 by using 69,000,000 passenger-car tires made with cold rubber for the year ended June 30, 1952. On this basis it is probable that the total investment of $700,000,000 made in the synthetic rubber program has already been more than matched by the savings since 1948 in cold rubber production alone, the Copolymer executive declared.

Approximately 685,000,000 pounds of cold rubber were produced during the year ending last June 30, and by far the largest percentage was used in tires. More than 1,400,000,000 pounds of cold rubber have been produced since 1948. Copolymer began commercial production of cold rubber in February, 1948, and the entire plant was converted to its production in May, 1949. Colonel Hulings also noted that the company has developed a cold rubber latex during the past year for use in manufacturing foam pillows, mattresses, upholstering, etc.

"This liquid latex gives every indication of being as outstanding in its field as is cold rubber in tires," Colonel Hulings stated.

John V. Schweppe has been appointed production superintendent at the Shelbyville, Ind., fiber glass producing plant of Pittsburgh Plate Glass Co. Associated with the company since 1946, Mr. Schweppe served as a supervisor in the tank department at the Creighton, Pa., plant.

Changes at Calco

Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., last month announced two executive changes, to become effective about January 1, 1953.

Alden R. Loosli has been named assistant to the general manager, S. C. Moody. Mr. Loosli came to Calco in 1937 as a student trainee and subsequently held supervisory positions in the various production departments of the chemical and intermediate division. Following a period of sales training in the intermediate and chemical sales department, he was appointed in 1947 assistant sales manager of the rubber chemicals department and in 1950, assistant manager of the intermediate and rubber chemicals department after the consolidation of these two departments.

V. E. Wellman succeeds Mr. Loosli in the latter capacity. Dr. Wellman was associated with The B. F. Goodrich Co. for 15 years, first as a research chemist and subsequently as director of purchases, chemicals division, and later was with R. W. Greeff Co. as assistant sales manager, solvents department. He joined Calco in 1945 and since 1951 has been director of process engineering.

Hettrick in New Post

Ames B. Hettrick has been appointed manager of the newly formed Calco engineering and development department, which consolidates all engineering and process development functions heretofore a part of the production and technical departments. Mr. Hettrick has been closely identified with the development of the commercially important titanium dioxide pigments. He began his career with Stone & Webster Engineering Corp. in 1928 and in 1931 went to Southern Mineral Products Corp. as chief engineer and became plant manager in 1934. When this company was purchased by Virginia Chemical Corp. in 1936, Hettrick was appointed vice president and general manager of the new organization. Upon the acquisition of Virginia Chemical's titanium interests by Calco in 1944, he became works manager of the Piney River, Va., plant operation and in 1946, assistant manager of manufacturing for Calco.

Petretti to Manage Camfield Plastics

Camfield Mfg. Co., Grand Haven, Mich., through President Lawrence V. Meyering, has announced the appointment of Mario J. Petretti as manager of the plastics division. Mr. Petretti, former national president of the Society of Plastics Engineers, Inc., was previously chief engineer of the plastics division of Continental Can Co. Camfield's plastics division plans to supply to industry a completely integrated service in low-pressure glass-polyester laminates, as well as vacuum forming of sheet plastic materials, and the custom molding of unplasticized polyvinyl chlorides.

Los Angeles Standard Rubber, Inc., 1500 E. Gage Ave., Los Angeles 1, Calif., recently elected Ben A. Gruver executive vice president and general manager; Harvey H. Morrison, vice president in charge of production; and Ray G. McAdam, sales manager.

MINNEAPOLIS
Sept. 29, through Oct. 1.

MILWAUKEE
Oct. 7, through Oct. 10.

ST. LOUIS
Sept. 23, through Sept. 26.

BUFFALO
Oct. 29, through Oct. 31.

NEW HAVEN
Nov. 11, through Nov. 13.

BALTIMORE
Nov. 18, through Nov. 20.

NEWARK
Nov. 4, through Nov. 7.

CINCINNATI
Oct. 21, through Oct. 23.

WINSTON-SALEM
Dec. 9, through Dec. 11.

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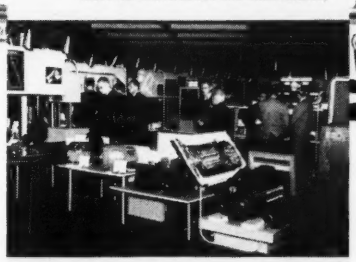
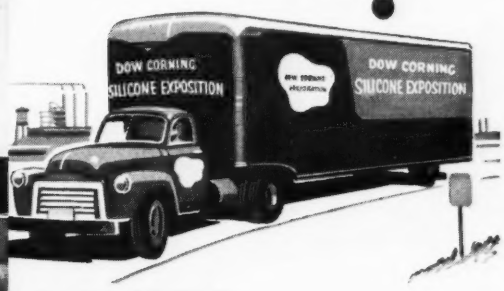
INDUSTRIAL MARKETING (June 1952)

"NEXT TO THE GREATEST SHOW ON EARTH . . . We could go on . . . reciting the fantastic properties of Silicones, but just as breathtaking as the materials were the display techniques used to demonstrate them . . ."
CIRCUIT RIDER (Vol. 6, No. 2, published by Electrical Construction and Maintenance)



". . . Heat Stability Plus: Visitors . . . see, among other demonstrations, how Silastic (Dow Corning's silicone rubber) remains soft and flexible at temperatures far above the limits of organic rubber . . ."
CHEMICAL WEEK (Jan. 26, 1952)

"IF YOU HAVEN'T already seen it, don't miss it when it comes around . . ."
POWER ENGINEERING (May 1952)



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They're rubber that won't melt on hot aircraft engine cylinders or freeze on switches that operate bomb bay doors at 100° below zero.

They're electrical insulating resins and varnishes that double the power of electric motors, or multiply by 10 the life of electric machines.

They're paints that protect metal at 1000°F. They're foam killers and release agents. They're a whole family of new engineering materials that can help you to improve your product or to cut production costs.

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Boynton Succeeds Mason

Haartz-Mason, Inc., Watertown, Mass., has a new president, Nehemiah Boynton, Jr., who was advanced from vice president and sales manager when former President and Cofounder Jesse H. Mason moved into the new position of chairman of the board. Also named was a new vice president, Lawrence R. Clarke, who has spent more than 20 years with the 26-year-old company.

Mr. Boynton joined Haartz-Mason in 1945, when he was elected sales manager. That same year he also became a vice president and under his guidance the company's business expanded into new markets and new products, the most important of which is electrical tape of all types, friction, rubber, and, more recently, plastic.

Haartz-Mason also makes gas-retaining fabrics; an imitation leather, Parafab, for inflated sporting goods; another leather-like coated fabric, Parahyde, used extensively on baby carriages; and coated fabrics for the automotive, footwear, garment, and novelty trades.

Elections at Faultless

Stockholders of The Faultless Rubber Co., Ashland, O., at their annual meeting on September 26 elected the following as directors: N. R. Duell, Curtiss Ginn, Jr., C. D. Hubler, W. A. McAfee, Geo. A. Meiler, T. W. Miller, Jr., and Western Wiles.

Then the board at its meeting, which followed the shareholders', named the following officers: president, Mr. Miller; vice president and treasurer, Mr. Meiler; vice president in charge of sales, Mr. Wiles; vice president in charge of manufacturing, John G. Roppel; vice president in charge of planning and procurement, Mr. Duell; secretary and assistant treasurer, Chas W. Ebert; assistant treasurer, R. L. Charlton; assistant secretary, R. C. Johnson.

Resumes Silicone Exhibit

Dow Corning Corp., Midland, Mich., has announced that the tour of its Silicone Exposition is being resumed in leading industrial areas of the country. Although several new demonstrations and sample products have been added during the three-month summer recess, the display is basically the same as seen last year by more than 17,000 executives and engineers from 4,600 different plants. The exposition is designed to illustrate the properties of the silicones as new engineering materials and is not open to the general public.

The schedule of showings this fall is as follows: September 23-26, Chase Hotel, St. Louis, Mo.; September 29 to October 1, Radisson Hotel, Minneapolis, Minn.; October 7-10, Hotel Astor, Milwaukee, Wis.; October 21-23, Sinton Hotel, Cincinnati, O.; October 29-31, Statler Hotel, Buffalo, N. Y.; November 4-7, Essex House, Newark, N. J.; November 11-13, Hotel Taft, New Haven, Conn.; November 18-20, Belevedere Hotel, Baltimore, Md.; and December 9-11, Robert E. Lee Hotel, Winston Salem, N. C.

Nehemiah Boynton, Jr.

Open Columbus Office

A. Bamberger Corp. and its affiliate, American Molding Powder & Chemical Corp., whose plant and main offices are at 703 Bedford Ave., Brooklyn, N. Y., are establishing a branch office at 8 E. Long St., Columbus, O., in charge of George A. Gould. This office will be maintained for the convenience and more efficient service of the companies' increasing number of customers and suppliers in Ohio, southern Indiana, and Kentucky.

A. Bamberger Corp. buys, sells, and reprocesses plastics scrap. American Molding Powder manufactures "Ampacet" thermoplastic molding compounds—more particularly cellulose acetate and pearl-effect polystyrene. Rapid expansion of both companies and the opening of many new accounts in the Midwest have necessitated the Columbus sales office.

CANADA

Gutta Percha Club Meets

Gutta Percha & Rubber, Ltd., Toronto, Ont., is undertaking an "aggressive program" of modernization and development of new products, M. O. Simpson, president, told the ninth annual meeting of the firm's 25-Year Club. Simultaneous meetings of the club's 350 members were held in Vancouver, Edmonton, Winnipeg, Montreal, Halifax, and London, England, where Gutta Percha has branch offices and warehouses. Forty per cent. of the company's active employes have been with Gutta Percha 25 years or more.

W. G. Britt has been appointed manager, molded goods sales, of The Goodyear Tire & Rubber Co. of Canada, Ltd., New Toronto, Ont. Mr. Britt, formerly sales promotion manager, will have headquarters in Quebec, P.Q., and will be responsible for developing the expanding market for molded rubber goods which has resulted from the industrial growth in Canada.

Rubber Consumption Drops

Combined stocks of rubber in Canada, natural, synthetic and reclaim, on July 31 increased to 13,484 long tons from the 11,397 tons on hand July 31, 1951; while July consumption declined to 5,245 long tons from 6,301 a year earlier. The Dominion Bureau of Statistics also reported domestic production of synthetic and reclaim rose to 6,658 long tons from 5,636.

Stocks of natural rubber at the end of July amounted to 4,533 long tons compared with 5,379 a year ago; synthetic, 7,533 tons, against 3,673; and reclaim, 1,418 tons, against 2,345.

Consumption of natural rubber totaled 2,125 long tons, against 3,284 in July, last year; synthetic 2,185 tons, against 1,862; reclaim, 935 tons, against 1,155.

Domestic output of synthetic rubber in July reached 6,412 long tons, compared with 5,434 a year ago; and reclaim rubber, 246 tons, against 202.

Consumption of rubber in Canada, in July, 1952, as compared with June, 1952, figures, shows a decrease in natural rubber of 878,524 pounds, in synthetic of 1,107,078 pounds, and in reclaim, of 298,801 pounds, for a total decrease of 2,284,403 pounds. In terms of end-products use, consumption of all rubber in the production of tires and tubes, including tire repair materials, declined by 1,003,581 pounds; in rubber footwear, by 408,409 pounds; in wire and cable, by 219,045 pounds; in other products, 653,368 pounds.

New Branch for Goodrich

B. F. Goodrich Rubber Co. of Canada, Ltd., Kitchener, Ont., last month opened new offices and branch warehouse at Ferrier St., Town of Mount Royal, to serve mining and logging interests in northern Quebec as well as the 5,000 company jobbers in the province. The new building, modern in every detail, has 6,000 square feet of office space of a total of 45,000 square feet of floor space. A tire recapping and retreading plant is also connected with the structure.

At the luncheon prior to the official opening of the building, attended by company and civic officials, Ira G. Needles, Canadian Goodrich president, was the principal speaker. Other executives present were W. E. Ireland and J. M. Robbins, vice presidents; G. C. Armstrong, secretary-treasurer; and J. C. Hagey, public relations manager.

New Playtex Plant

Playtex, Ltd., Montreal, P.Q., is erecting a new plant at Arnprior, Ont., to manufacture girdles and foam rubber products. Construction will cost more than $750,000, and the plant will employ 300 persons when full production is reached. Completion of the plant is expected early next year. Playtex is a subsidiary of International Latex Corp., Dover, Del.

Robert Campbell has been named vice president and general manager of Rogers Plastics (Canada), Ltd., Rawdon, P.Q. He has been with the concern several years.

Witco-Continental carbon blacks

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Witco-Continental carbon blacks are uniform, dependable, carefully tested . . . delivered to your plant by hopper car, freight car or truck.

Shipments in 50 lb. bags can be palletized for convenient, economical handling where fork lift trucks are available at destination.

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Continex HMF
Continex HAF
Continex FEF

CHANNEL

Continental F, Witco No. 6 — HPC
Continental A, Witco No. 1 — MPC
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Witco-Continental's modern hopper cars, distinguished by the company name, deliver the best in carbon black right to your door.

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NEWS ABOUT PEOPLE

Lawrence W. Widdecombe, Jr., and **Harold Spector** have joined the collodial products development section of the Naugatuck Chemical Division, United States Rubber Co. Mr. Widdecombe will have charge of the paint laboratory, supervising research and technical service work on latex paints; while Mr. Spector will direct the division's paper laboratory, supervising research on applications of plastic latices in the paper industry.

John Dietze has been named to the staff of R. N. Griswold, mid-central regional sales manager, pigment department, American Cyanamid Co., Calco Chemical Division, Bound Brook, N. J. Mr. Dietze will call on the trade in the Detroit-Toledo-Cleveland territory and will make his headquarters at the Cleveland office. He joined Calco in 1947 and was made a pigment department sales representative in the New York territory two years later. A veteran of World War II, Dietze was recalled to active duty in 1950 and served as a captain in the U. S. Marine Corps in the Mediterranean and African areas, completing his tour of duty in July, 1952.

Alfred P. Daignault and **Anatole Lucas**, of Monsanto Chemical Co.'s plastics division, Springfield, Mass., have been named thermoplastics sales representatives with headquarters in Detroit, Mich. Both men joined Monsanto early this year to train for their new positions.

Robert E. Cryor, vice president in charge of manufacturing of the fibrous products division, Union Asbestos & Rubber Co., 332 S. Michigan Ave., Chicago 4, Ill., last month was made vice president in charge of government and industry relations for all of the company's divisions and products.

Emil T. Johnson, in charge of engineering and research at Union Asbestos, has been appointed director of production and engineering of the fibrous products division.

Richard T. Bules has been appointed manager, V-belt sales, industrial products sales department, for The B. F. Goodrich Co., Akron, O., to succeed George J. Fischer, resigned. Bules has been with Goodrich for 12 years. His first job was weighing uncured tires and tubes, but he also served as a cadet on the company's police force from December, 1941, to May, 1943. For the next few years he was with the replacement tire division's accessory sales department. Upon his graduation from Akron U. in 1946, Bules joined the V-belt sales department as a sales correspondent and also filled various capacities in the sales department until his recent appointment.

Harry E. Thompson, director of research for Anaconda Wire & Cable Co., Hastings, N. Y., will be a member of a discussion panel at the October 15 meeting of the Metropolitan Section, American Society for Quality Control, held in New York, N. Y. Subject of the panel is "Managing a Quality Control Program."

Lester D. Koch

Lester D. Koch recently was made eastern sales manager of Witco Chemical Co., 295 Madison Ave., New York 17, N. Y., to handle the company's chemicals including metallic stearates, paint driers, stabilizers, and plasticizers. Mr. Koch, a vice president of Witco, will continue to supervise the operations of the export-import department as he has in the past.

Frank Walsh has been named by Baker Castor Oil Co., 120 Broadway, New York 5, N. Y., sales representative for the Middle Atlantic region, covering eastern Pennsylvania, Delaware, Virginia, Maryland, and the Carolinas, with headquarters in Philadelphia, Pa. Mr. Walsh previously had been on the sales staff of Merck & Co., Inc.

George B. Moseley has been named general sales manager of Firestone Steel Products Co., Akron, O. Mr. Moseley, formerly sales manager for contract manufacturing, joined Steel Products in March, 1949. Previously he had been employed by engineering and steel fabricating companies in Cleveland for 10 years.

Donald H. Walker has been named assistant treasurer of the Goodyear Tire & Rubber Co., Akron, O., succeeding Harry W. Hillman, recently made comptroller. Mr. Walker comes to his new position from Goodyear-Mexico, where for the past 19 months he was secretary-treasurer of the company's Mexican subsidiary.

William G. Potts has been transferred from the engineering department to the plastics machinery sales department of National Rubber Machinery Co., Akron 8, O. While a member of the engineering department, he was assigned to the plastics machinery section. Potts attended the University of Akron and joined NRM in 1940. During World War II he served 3½ years in the Army Air Force.

Robert B. Baird has been elected a vice president of Baird Rubber & Trading Co., Inc., 233 Broadway, New York 7, N. Y. He joined the company in March, 1948, in an executive capacity after having been with Acme-Hamilton Mfg. Corp., Trenton, N. J., for two years, following his service in the Air Force. He was named secretary and a director of the Baird company in December, 1948, positions he will continue to hold. Last year he made a trip to the Far East, on a round-the-world journey, to further the Baird crude rubber importing business.

William R. Angele has returned to the shipping department of the Baird company, following service in Japan as a captain in the finance department of the Army Transportation Corps.

Carmen R. Giannotta has joined the technical service staff of the chemical manufacturing division of M. W. Kellogg Co., producer of the fluorocarbon plastic, Kel-F. Mr. Giannotta, formerly supervisor of the plastics laboratory of Eastman Kodak Co., has been active in the field of plastics for the past ten years, during which time he was also associated with the General Chemical Co., Industrial Engineering Co., and as a Naval officer attached to the office of Naval Inspection of Ordnance.

Reed A. Weyburn has been appointed representative-distributor sales by Flexible Tubing Corp., Guilford, Conn., and will assist A. H. Loux,, manager-distributor sales, in work with the company's expanding network of distributors across the country. Previously, Mr. Weyburn had been with Connecticut Light & Power Co. for seven years and had been with The Stanley Works as a sales engineer in charge of the Pacific Northwest for the steel strapping division.

William A. Santel has been named sales manager of the new fine chemicals department of C. P. Steuber & Co., 250 W. 43rd St., New York 17, N. Y., export specialist for chemicals and plastics. Mr. Santel was formerly sales manager for Belgian American Mercantile Corp. and prior to that was associated with U. S. Industrial Chemical Co. for many years. The newly established fine chemicals department of C. P. Steuber will concentrate entirely on the promotion of foreign markets for specialty chemicals produced by the U.S.A. chemical industry.

Roland H. Guinzburg, vice president of Kleinert's, 485 Fifth Ave., New York 17, N. Y., and **Bill White**, also of Kleinert's, left for London September 17 for a six week's stay to complete the transfer of a new British factory to the existing Kleinert factory in England. Mr. Guinzburg will also coordinate production with the requirements of the London sales office and other offices and agencies within the sterling area.

Otto F. Slonek, formerly manager of Industrial Chemical Service, Inc., Houston, Tex., has been added to the staff of Witco Chemical Co. in a technical sales service capacity on chemicals.

RIGHT DOWN YOUR ALLEY...

For "KING PIN" Results Everytime!

EASY PROCESSING

Reinforcing High Styrene Resin

Marbon "8000"

- Eliminates prior Masterbatching.
- Combines higher hardness plus higher modulus.
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Can be added directly to your rubber compounds!

ORDER NOW! STOCK READILY AVAILABLE!

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MARBON CORP.

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It BLENDS as it STRENGTHENS as it IMPROVES

Leland E. Spencer, who recently resigned as chief of the synthetic rubber division of the Reconstruction Finance Corp. has been made assistant to President E. J. Thomas, of The Goodyear Tire & Rubber Co., Akron, O.

Leslie D. Carver, director of technical service, carbon black division, Witco Chemical Co., 295 Madison Ave., New York 17, N. Y., is spending two months abroad visiting the various branches and agencies of the Witco company throughout Europe. Mr. Carver has been invited also to address several meetings of rubber technicians.

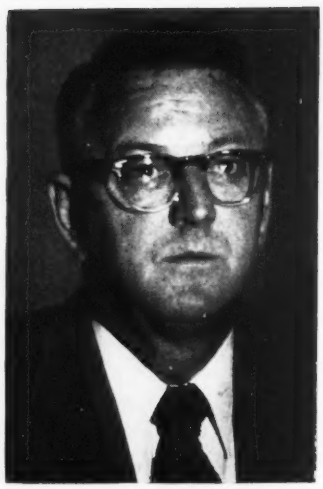
Austin Goodyear has been elected a director of Hewitt-Robins, Inc., Stamford, Conn. With the company since 1941, Mr. Goodyear is general manager of two divisions, the rubber division, which manufactures industrial rubber products at Buffalo, N. Y., and the conveyors division, which has plants in Passaic, N. J., and Philadelphia, Pa., for the manufacture of machinery components for conveyor systems.

John H. Ingalls, Jr., having joined the sales staff of the rubber specialties division, Dewey & Almy Chemical Co., Cambridge, Mass., will handle sales of meteorological balloons to government and private institutions and the Armed Services and of rubber bladders to manufacturers of athletic equipment. He was formerly a salesman with the Standard Service Bureau, Boston.

David L. Flanders has become manager of purchasing, textiles, advertising, and paper products, for The B. F. Goodrich Co., Akron, O. Flanders joined Goodrich as a laboratory chemist in 1937 and became manager of raw materials inspection and development in December, 1939, assistant manager of the physical testing laboratory in February, 1947, and manager of purchasing, chemicals and pigments in April, 1947.

William F. Gerrow, Jr., field sales representative of Goodyear Tire & Rubber Co.'s chemical division who has been in training at the division's district office in Atlanta, Ga., has been assigned permanently to that location. His primary activities there in the heart of the southern textile industry, will be contacting the textile trade.

William L. Batt, minister in charge of the Economic Cooperation Administration mission to the United Kingdom and president of SKF Industries, Inc., has been awarded the Howard Coonley Medal for long and distinguished service in the standardization movement. The American Standards Association presents the award annually to an executive "who by his practice and preachments has furthered the national economy through voluntary standardization. Presentation of the medal will be made November 25 at the thirty-fourth annual meeting of the Association at the Waldorf-Astoria, New York, N. Y. Mr. Batt in wartime held such posts as vice chairman of the War Production Board, U. S. member and representative on the Combined Raw Materials Board, and the Combined Production and Resources Board, and chairman of the Inter-Agency Policy Committee on Rubber.



Norman Johnson

Norman Johnson has been appointed assistant to President Zina A. Wise, of Griffith Rubber Mills, 2439 N.W. 22nd Ave., Portland, Oreg. Johnson has been with the organization more than 10 years and for the past year has served as assistant general manager. He was assistant treasurer from 1947 to 1951. As a member of the nation's rubber industry "Watch Dog" committee, Johnson has worked with the Senate small business committee on matters of rubber allocation and controls for the past two years. Griffith Rubber Mills has been manufacturing rubber products since 1911 and specializes in rubber items for paper mills and other Northwest industries. It also manufactures numerous rubber specialties including a marine line of rubber boat bumpers and deck mats, and a Sea Hawk line of rubber beverage glass coasters and floor mats.

German C. Flick has been appointed by United States Rubber Co. sales manager of its decorative plastic topping material, Satusply, and of its plastic wall covering, Naugawall with headquarters at the Mishawaka, Ind., plant where the products are made. Mr. Flick started with the company in April, 1951, as Satusply salesman. In his new position he succeeds **Edward Walsh,** assigned other sales responsibilities in the fuel cell division.

Miss Mabel Kaltenbaugh has been elected secretary-treasurer of Castle Rubber Co., East Butler, Pa., which she joined more than 19 years ago. She succeeds N. E. Brown, who has retired and moved to Florida after having been secretary-treasurer of the Castle company since it was founded in 1922.

S. J. Heideman has been assigned to the newly created post of special representative of the vice president in charge of sales at Lee Tire & Rubber Co. of New York, Inc. Conshohocken, Pa. Heideman came to Lee after 18 years with The Atlantic Refining Co., where he was manager of tire, battery, and accessory sales. In his new post Heideman will contact dealers throughout Lee's five sales regions, embracing New England, the middle Atlantic states, and the Southeast.

T. J. Kinsella, in charge of the Barrett Division of Allied Chemical & Dye Corp., 40 Rector St., New York, N. Y., as executive vice president, has been appointed president of this division. Mr. Kinsella came to Barrett in January, 1947, prior to which—from 1941 to 1947—he was Price Executive of the Industrial Machinery Branch, Office of Price Administration, as well as OPA representative on the War Procurement Policy Board.

Lawrence C. Ebel, supervisor of the electrical laboratory of the research department, Anaconda Wire & Cable Co., Hastings, N. Y., was a member of one of the group discussions held at the regular meeting of the National Electronic Distributors Association, Atlantic City, N. J., September 22-25. Mr. Ebel sat on the panel of manufacturers who discussed ultra high-frequency television.

Robert H. Barbour has been made manager of the Sirvene division of Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill., and will also continue his previous duties as technical director of the division. **H. C. Crosland** has been named assistant technical director of the division.

Purdy Miller has been appointed manager of molded goods sales, mechanical goods division, United States Rubber Co. Mr. Miller, who will make his headquarters in Passaic, N. J., was formerly assistant manager of the Chicago branch and has had many years of experience in sales and branch management.

OBITUARY

John R. Lotze

JOHN R. LOTZE, manager of passenger-tire and sealed-air tube sales for Seiberling Rubber Co., Akron, O., died September 2 in an Akron hospital, after having been confined there since August 18.

A native of Trenton, N. J., Mr. Lotze was 55 years old.

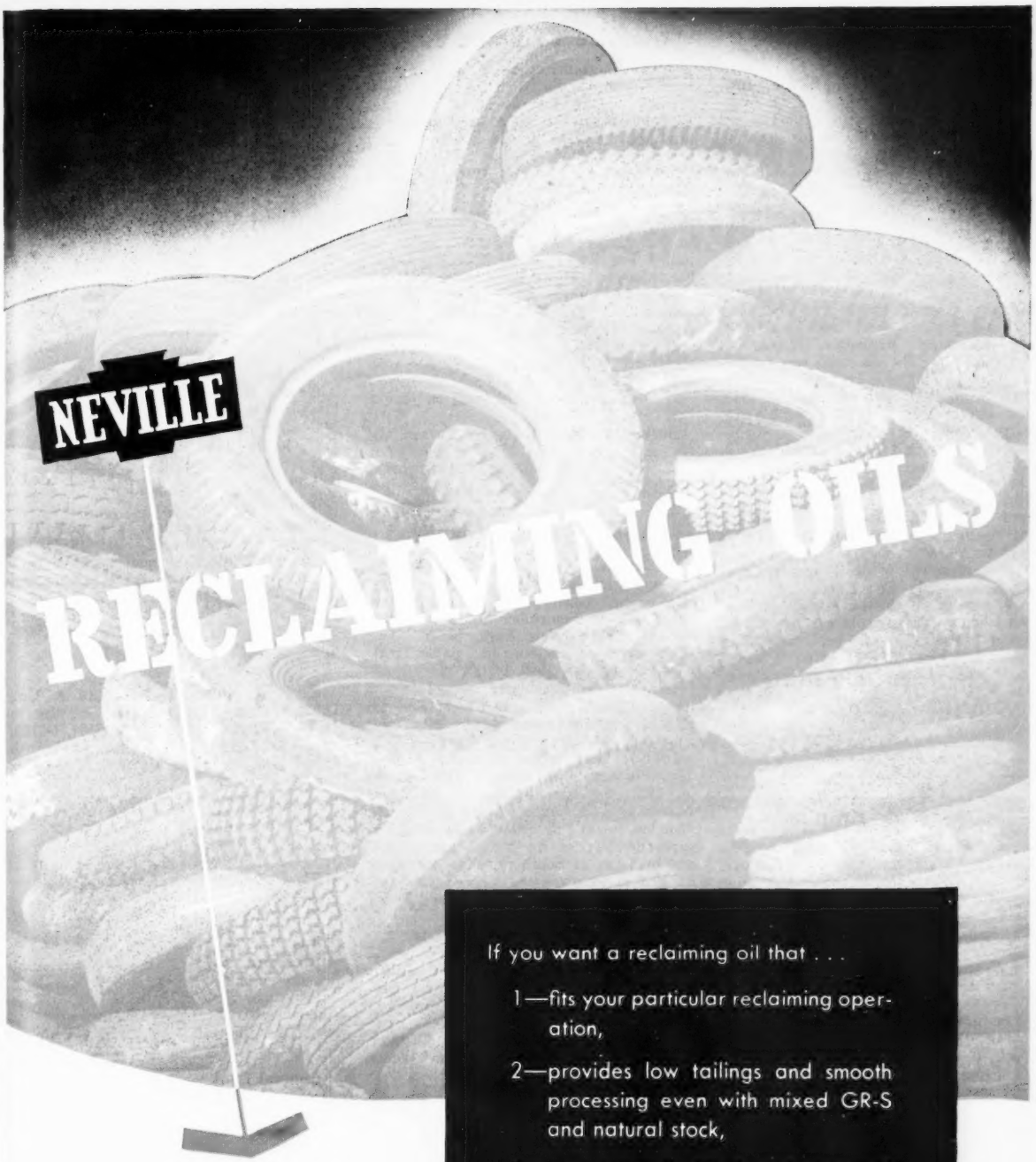
Prominent in the rubber industry for more than 28 years, John Lotze held various sales assignments with Firestone Tire & Rubber Co. and General Tire & Rubber Co., from 1916 to 1924, when he formed a retail tire dealership in Canton, O. Then from 1930 until 1942 he was president of Safety Tire Co., Youngstown, O. In 1946 he came to Seiberling, where he worked in the merchandising department until he successively became manager of dealer development, merchandising manager, and in July, 1949, manager of passenger-tire and sealed-air tube sales.

The deceased was a naval officer during World War I and in World War II served as a lieutenant colonel in the Air Force, in charge of the tire depot in Ontario, Calif.

He also belonged to the Elks Lodge.

The widow, three daughters, three sons, three sisters, and a brother survive.

Requiem Mass was said September 5 in St. Sebastian Church, followed by interment in Holy Cross Cemetery, both in Akron.



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2—provides low tailings and smooth processing even with mixed GR-S and natural stock,

3—gives controlled tack and improved tensile . . .

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R 46

Frederick L. Curtis

FREDERICK L. CURTIS, retired executive of Raybestos-Manhattan, Inc., and former general manager of the Manhattan Rubber Division plant, Passaic, N. J., died September 20 at his home in that city.

Mr. Curtis was born in Sandy Hook, Newtown, Conn., 84 years ago.

He began his career in the rubber business as a shipping room boy in the parent plant of New York Belting & Packing Co. in Sandy Hook when he was 14 years old, but soon left that job to attend business school.

Later he returned to New York Belting, where he remained until December, 1895, when he joined Manhattan Rubber as office manager. The deceased rose to become secretary of the company in 1903, a director in 1912, vice president in 1913, senior vice president and assistant general manager three years later, general manager of Manhattan Rubber Division in 1940, and treasurer in 1942.

On April 6, 1948, he retired, the last of the pioneers to hold office or be employed by Manhattan Rubber when the plant began operations.

Mr. Curtis was one of the organizers and first president of New Jersey Engineering & Supply Co., Passaic. He was also a member of the Passaic City, Youtakah Country, and Arcola Country Clubs.

Funeral services were held September 22 at the First Presbyterian Church, Passaic, followed by burial in Newtown, Conn.

A brother is the sole survivor.

Donald A. Rankin

DONALD A. RANKIN, superintendent of the Barrett Shadyside research laboratory of Allied Chemical & Dye Corp., New York, N. Y., died September 19.

Mr. Rankin was born February 2, 1906, in Fitchburg, Mass. He was graduated from Waltham High School, and from Harvard University, where he received a B.S. degree in 1927.

After graduation he took a job with E. I. du Pont de Nemours & Co., Inc., but left in 1934 to join the Barrett Division. From 1944 until his death the deceased was superintendent of the Barrett Shadyside research laboratory at Edgewater, N. J.

A fellow of the American Institute of Chemists and a member of the American Chemical Society, Mr. Rankin held several patents.

Surviving are his wife, one son, and a daughter.

Otho J. De Lon

OTHO J. DE LON, 58, salesman for American Cynamid Co.'s industrial chemicals division in the Chicago district, died suddenly on September 19 at Kokomo, Ind. Mr. De Lon became a member of Cyanamid in 1929 when the Kalbfleisch Corp. was acquired by the company. He was made a salesman for the industrial chemicals division in 1932.

Funeral services were held September 22 at Jacob's Funeral Home, Kokomo.

Maurice C. Yarbarough

FUNERAL services were held July 31 in Akron, O., for Maurice Charles Yarbarough, plant superintendent, Faultless Rubber Co., Ashland, O., who suffered a fatal heart attack July 28 after an illness of five weeks.

Interment took place in Rose Hill Burial Park, also in Akron.

The deceased attended Actual Business College, Akron, and began his career in the rubber industry in 1919 when he joined The B. F. Goodrich Co. as a rubber technician. He resigned in 1948, to join Standard Products as a production superintendent. In 1950, he started with Faultless Rubber as plant superintendent.

Maurice Yarbarough was a member of the North Hill Church of Christ and Loyalty Lodge 645, F.&A.M., both in Akron.

He was born in Oxford, Ind., on June 3, 1897.

Survivors include the widow, a son, and two sisters.

Andrew H. Driver, Sr.

ANDREW HOWARD DRIVER, SR., manager of the J. M. Huber Corp. clay plants, Aiken, S. C., suffered a fatal heart attack September 9 while on a business trip to New York, N. Y.

The deceased was born in Cripple Creek, Colo., March 20, 1898.

He attended grammar school for a time at Baker, Oreg., but completed his education at the Horace Mann elementary and high schools in New York.

In 1916, Mr. Driver went into business with his father in New York, but left in 1921 for various selling jobs. He started with Huber as a foreman at the Langley plant in June, 1929, became superintendent of its No. 1 plant, 1934, and manager of South Carolina operations in 1939.

During World War I he served in the Navy.

Andrew Driver was active in Boy Scout work. He was also a member of the Aiken Presbyterian Church, Aiken, where funeral services were held September 11. Burial took place in Westover Cemetery, Augusta, Ga.

Survivors include the widow, a daughter, a son, his mother, one brother, two sisters, and six granchildren.

FINANCIAL

Anaconda Wire & Cable Co., New York, N. Y. June half, 1952: net profit, $3,092,344, equal to $3.66 a share, against $3,120,776, or $3.70 a share, in the 1951 half.

Baldwin Rubber Co., Pontiac, Mich. Year to June 30, 1952: net earnings, $902,697, equal to $2.29 a common share, compared with $1,224,327, or $3.11 a share, in the preceding fiscal year.

Dayton Rubber Co., Dayton, O. Nine months to July 31, 1952: net income, $1,134,357, equal to $1.96 a common share.

Brown Rubber Co., Inc., Lafayette, Ind. January 1-June 28, 1952: net income, $453,421.36, 30% under the 1951 figure; current assets, $2,473,965.24; current liabilities, $354,381.99.

Carborundum Co., Niagara Falls, N. Y. First six months, 1952: net profit, $2,490,658, equal to $1.63 a share, contrasted with $3,192,687, or $2.09 a share, in the 1951 period.

Crown Cork International Corp., Baltimore, Md. June half, 1952: net earnings, $295,905, equal to $1.57 a share, against $291,945, or $1.55 a share, in last year's half.

Dewey & Almy Chemical Co., Cambridge, Mass. First half, 1952: net loss, $44,473, contrasted with net earnings of $797,746 in the first six months last year; net sales, $12,493,443, against $15,069,357.

The Dow Chemical Co., Midland, Mich. Year ended May 31, 1952: net earnings, $35,818,010, equal to $4.96 each on 6,961,203 common shares, compared with $40,534,744 or $6.00 each on 6,530,516 shares, in the preceding fiscal year; net sales, $407,158,799, against $339,588,268.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Six months to June 30, 1952: net income, $101,768,123, equal to $2.12 a share, compared with $118,401,955, or $2.50 a share, in the like period last year.

Firestone Tire & Rubber Co., Akron, O., and subsidiaries. Nine months to July 31, 1952: net income, $29,099,954, equal to $7.35 a share, compared with $33,473,195, or $8.47 a share, a year earlier; sales, $699,129,079, against $689,600,136.

Flintkote Co., New York, N. Y. Twenty-eight weeks to July 12, 1952; net income, $2,009,375, equal to $1.45 a common share, compared with $3,139,602, or $2.35 a share, in the 1951 weeks.

General Cable Corp., New York, N. Y. First six months, 1952: net profit, $2,469,954, equal to $1.10 each on 1,933,372 common shares, against $2,693,789, or $1.21 each on 1,932,682 shares, in last year's half.

Glidden Co., Cleveland, O. Nine months to July 31: net profit, $4,139,619, equal to $1.81 a common share, compared with $5,840,220, or $2.56 a share, a year earlier.

Goodall-Sanford, Inc., Reading, Mass. Year ended June 30, 1952: net profit, $2,026,785, equal to $3.02 a common share, compared with $2,324,476, or $3.90 a share, in the preceding fiscal year; net sales, $63,621,352, against $62,530,300.

B. F. Goodrich Co., Akron, O. First six months, 1952: consolidated net income, $14,905,791, equal to $3.46 each on 4,158,316 common shares, compared with $16,176,202, or $3,79 each on 4,123,116 shares, in the like period last year; net sales, $297,278,822, against $322,175,790.

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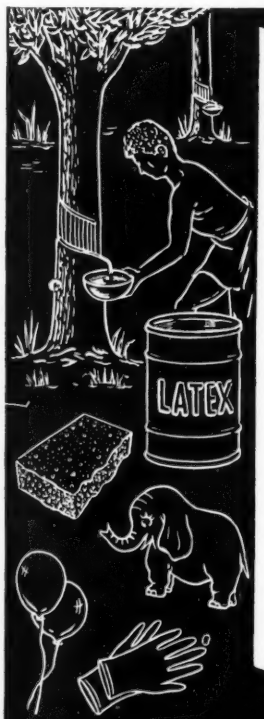

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Goodyear Tire & Rubber Co., Akron, O., and subsidiaries. Six months to June 30, 1952: net profit, $15,480,369, equal to $3.39 a common share, compared with $20,685,820, or $4.66 a share, in the 1951 half; net sales, $568,833,355, against $544,642,341.

Hewitt-Robins, Inc., Stamford, Conn. First six months, 1952: net income, $466,317, equal to $1.63 each on 286,051 common shares, compared with $633,844, or $2.27 each on 278,714 shares, in the like period last year; net sales, $19,122,369, against $18,066,678.

Intercontinental Rubber Co., Inc., New York, N. Y., and subsidiaries. First six months, 1952: net income, $39,208.43, compared with $253,649.40 in the first half of 1951.

Byron Jackson Co., Los Angeles, Calif. Half ended June 30, 1952: net profit, $703,792, equal to $1.33 each on 529,857 capital shares, against $774,980, or $1.46 each on 529,855 shares, a year earlier.

Johnson & Johnson, New Brunswick, N. J., and domestic subsidiaries. June half, 1952: net income, $3,963,300, equal to $1.85 each on 2,091,670 common shares, compared with $5,219,000, or $2.45 each on 2,090,123 shares, in last year's period; sales, $93,580,000, against $99,929,000.

Mansfield Tire & Rubber Co., Mansfield, O. Six months to June 30, 1952: net earnings, $591,321, equal to $1.07 a share, compared with $1,588,032, or $2.84 a share, in the preceding year's half.

Minnesota Mining & Mfg. Co., St. Paul, Minn. Half ended June 30, 1952: net earnings, $7,287,400, equal to 91¢ each on 8,007,549 common shares, against $7,360,939, or 92¢ a share, in the corresponding months of 1952; sales, $88,074,407, against $85,850,163.

O'Sullivan Rubber Corp., Winchester, Va. Initial half, 1952: net income, $53,843, equal to 9¢ a share, compared with $147,057, or 33¢ a share, in the like period last year.

Aetna-Standard Engineering Co., Pittsburgh, Pa., and subsidiary. Year ended June 30, 1952: net income, $774,285.34, compared with $829,987.01 in the preceding fiscal year; net sales, $20,520,386.84, against $9,575,183.42; provision for income taxes, $1,013,000, against $622,000; allowances for depreciation, etc., $267,277.77, against $92,336.86.

National Lead Co., New York, N. Y. First half, 1952: consolidated net income, $11,074,640, equal to 98¢ a common share, compared with $12,961,777, or $1.17 a share in last year's half; sales, $176,185,388, against $204,891,292.

Parker Appliance Co., Cleveland, O. Year ended June 30, 1952: consolidated net earnings, $834,257, equal to $2.58 a share, compared with $577,953, or $1.79 a share, in the preceding fiscal year; consolidated net sales, $21,879,316, against $12,201,432; provision for federal income taxes, $2,006,000, against $1,022,748.

Phelps Dodge Corp., New York, N. Y., and subsidiaries. Six months to June 30: net earnings, $17,551,944, equal to $1.73 a capital share, against $21,156,559, or $2.08 a share, in the preceding year's months.

Pittsburgh Coke & Chemical Co., Pittsburgh, Pa. June half, 1952: net earnings, $996,000, equal to 98¢ a share, contrasted with $1,634,000, or $1.97 a share, in last year's half.

Pittsburgh Plate Glass Co., Pittsburgh, Pa. First half, 1952: net earnings, $17,765,435, equal to $1.97 a common share, against $19,479,859, or $2.16 a share, in last year's half.

Raybestos-Manhattan, Inc., Passaic, N. J. First half, 1952: net income, $1,608,291, equal to $2.56 a common share, contrasted with $2,558,422, or $4.07 a share, in the June half last year.

Rome Cable Corp., Rome, N. Y. June quarter, 1952: net income, $562,925, equal to $1.15 each on 481,767 common shares, against $489,043, or $1.05 each on 458,260 shares, in the June quarter of 1951.

National Rubber Machinery Co., Akron, O. Six months ended June 30: net profit, $285,134, equal to $1.62 each on 176,000 capital shares, compared with $238,645, or $1.55 each on 154,000 shares, in the like period last year; net sales, $9,236,967, against $3,905,000.

St. Joseph Lead Co., New York, N. Y. Six months to June 30, 1952: net profit, $6,657,513, equal to $2.45 a common share, against $7,729,138, or $2.84 a share, in last year's half.

Shell Oil Co., New York, N. Y. Six months to June 30, 1952: net earnings, $42,554,913, equal to $3.16 a share, against $45,220,846, or $3.36 a share, in the corresponding period last year.

Skelly Oil Co., Kansas City, Mo. Half ended June 30, 1952: net profit, $13,224,566, equal to $4.60 a common share, compared with $14,405,385, or $5.01 a share, in the 1951 period.

Sun Chemical Corp., New York, N. Y., and subsidiaries. June half, 1952: net profit, $535,945, equal to 41¢ each on 1,196,283 common shares, against $889,324, or 71¢ a share, in the 1951 half; net sales, $20,606,223, against $22,008,353.

Timken Roller Bearing Co., Canton, O. First six months, 1952: net earnings, $5,968,877, equal to $2.46 each on 2,241,380 capital shares, contrasted with $8,148,039, or $3.37 a share, in the same period of 1951.

U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y. Thirty-six weeks ended September 7, 1952: net income, $144,080, against $337,734 in the like period last year.

United Engineering & Foundry Co., Pittsburgh, Pa., and subsidiaries. First half, 1952: net income, $1,933,587, equal to 77¢ a common share, compared with $1,933,944, or 77¢ a share, in the 1951 half; net sales, $42,544,934, against $29,363,816.

S. S. White Dental Mfg. Co., Philadelphia, Pa., and subsidiaries. First half, 1952: net profit, $510,309, equal to $1.46 each on 349,999 capital shares, against $680,522, or $1.94 each on 349,919 shares, in last year's half; net sales, $12,243,817, against $12,381,611.

Dividends Declared

Company	Stock	Rate	Payable	Stock of Record
American Hard Rubber Co.	Com.	$0.25	Oct. 31	Oct. 24
	Pfd.	0.87½ q.	Sept. 30	Sept. 23
Armstrong Rubber Co.	A & B Com.	0.50 q.	Oct. 1	Sept. 15
	4¾% Pfd.	0.59⅜ q.	Oct. 1	Sept. 15
Canadian General Electric Co., Ltd.	Com.	2.00 q.	Oct. 1	Sept. 15
Crown Cork International Corp.	Cl. A	0.25 q.	Oct. 1	Sept. 15
Dayton Rubber Co.	Com.	0.50 q.	Oct. 24	Oct. 9
Dewey & Almy Chemical Co.	Com.	0.15	Sept. 20	Sept. 12
General Tire & Rubber Co.	3¼% Pfd.	0.81¼ q.	Sept. 30	Sept. 19
	3¾% Pfd.	0.93¾ q.	Sept. 30	Sept. 19
	4¼% Pfd.	1.06¼ q.	Sept. 30	Sept. 19
B. F. Goodrich Co.	Com.	0.50	Sept. 30	Sept. 9
Goodyear Tire & Rubber Co. of Canada, Ltd.	Com.	1.00 q.	Sept. 30	Sept. 9
	Pfd.	0.50 q.	Oct. 31	Oct. 10
Hewitt-Robins, Inc.	Com.	0.50 q.	Sept. 15	Sept. 2
Jenkins Bros. Co.	Pfrs.	1.00	Sept. 29	Sept. 19
	Pfrs. Non-Vot. Com.	0.25	Sept. 29	Sept. 19
Johns-Manville Corp.	Com.	0.75	Sept. 15	Sept. 2
Mansfield Tire & Rubber Co.	Com.	0.40 q.	Sept. 20	Sept. 10
O'Sullivan Rubber Co.	5% Pfd.	0.25 q.	Oct. 1	Sept. 15
		0.25*	Oct. 1	Sept. 15
Raybestos-Manhattan, Inc.	Com.	0.50	Sept. 12	Aug. 29
Union Asbestos & Rubber Co.	Com.	0.25 q.	Oct. 1	Sept. 10

*Clearing arrears.

Compounding Ingredients—Price Changes and Additions

Bonding Agents

Kalabond	gal.	$6.50	/ $16.00
Tie Cement	gal.	2.00	/ 5.60

Plasticizers and Softeners

Baker AA Oil	lb.	.26	/ .32
Crystal O Oil	lb.	.275	/ .335
Processed oils	lb.	.28	/ .315

Vulcanizing Agents

Ko-Blend I. S.	lb.	.385

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Use this new black in tire treads, industrial belts, and any place where you need really "super" performance! It beats any black previously marketed!

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12% TO 24% BETTER in natural rubber truck tire treads, compared with EPC black. Philblack E also gives super resistance to cut and crack growth.

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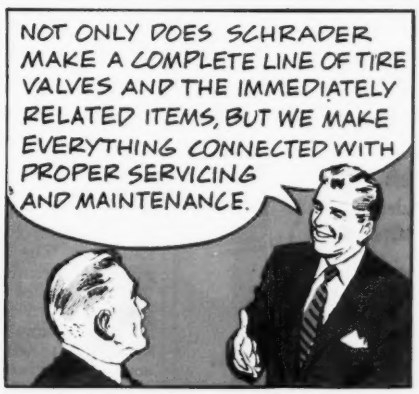
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Money-consuming downtime on mill roll changing is cut to the bone by the wholly automatic B & S Shaftless Backstand. Here is what Mr. C. Carr Sherman, President of H. P. Smith Paper Co., has to say about this equipment:

"The engineering of this new unit indicates a fine understanding of the problems of the users of this type of equipment. The Backstand is much easier to handle as there are no shafts. It is also much easier and faster to make changes on it. I believe that changing rolls with this Backstand can be brought down to well under one half minute."

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For full details on the Shaftless Backstand and the new B & S Slitters and Rewinders, write to The Bagley & Sewall Company, Watertown, N. Y.

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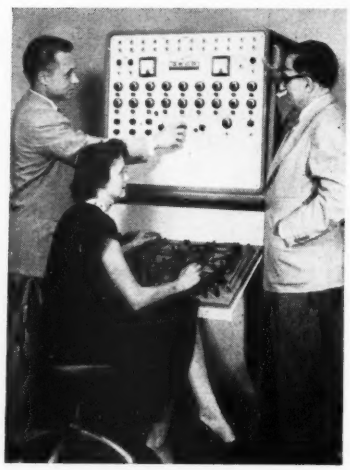
Electronic Analyzer for Industry



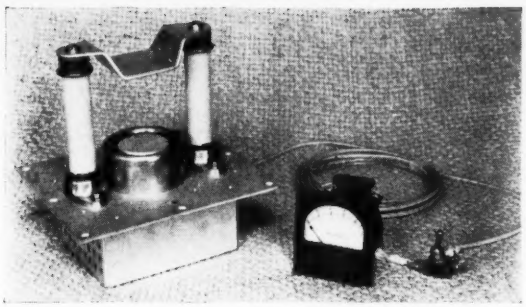
New Goodyear L3 GEDA Electronic Analyzer

A NEW electronic "brain" which can provide greater production efficiency in the rubber and textile industries has been developed by Goodyear Aircraft Corp., Akron, O. Called the L3 GEDA (Goodyear Electronic Differential Analyzer), the computing device ferrets out inefficiencies in machines, methods, and materials, enabling designers to perfect their equipment. The establishment of new flow patterns and improved automatic control systems for factory production processes is also possible with the new analyzer. While previously used mostly for classified work under government contract, the L3 GEDA is now available as a commercial product for use in a variety of fields.

The analyzer solves problems in terms of voltages and wave forms which are transcribed on to paper in recording machines and interpreted by trained technicians. Problems of direct simulation are answered through a study of electrical and mechanical circuits. By substituting different voltages in the L3 GEDA for the different parts of an equation, any problem of motion that can be translated into a mathematical equation can be solved with this machine.

The L3 GEDA gives the appearance of a modern, streamlined telephone switchboard. It is operated entirely from the front, and the control panel is sloped for easy reading of dials and indicators. The problem board facing the operator is made of glass fiber reinforced plastic and is easily removed for wiring purposes. Space is provided between the control panel and the problem board for the mounting of auxiliary equipment. Maintenance is simplified by the use of plug-in units and by panels designed to swing out, up, or down to make almost all parts accessible without the need of unsoldering or removing a single wire.

Rapid Cure?
SEE PAGE 4



Westinghouse Voltmeter for Dielectric Heating Loads

New Voltmeter

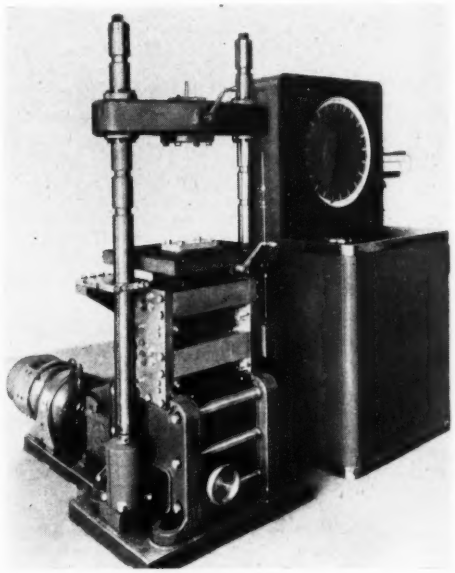
A VOLTMETER that measures the RMS (square root of mean square) values of radio frequency voltages in dielectric heating loads is now available from Westinghouse Electric Corp., Pittsburgh 30, Pa. The instrument will indicate to the operator of a dielectric heating apparatus the amount of heat that is being applied to the electrodes, and eliminates previous trial and error methods of electrode adjustment.

The voltmeter consists of a capacity voltage divider and a crystal rectifier unit, connected to an indicating instrument calibrated in kilovolts. No external power is required for operation other than that taken from the RF voltage source (less than 0.1-watt). Both 0-5,000 and 0-10,000 volts scale ranges are available for measuring RMS values, and frequency ratings are made in 200-3,000 kilocycles and 3-50 megacycles ranges.

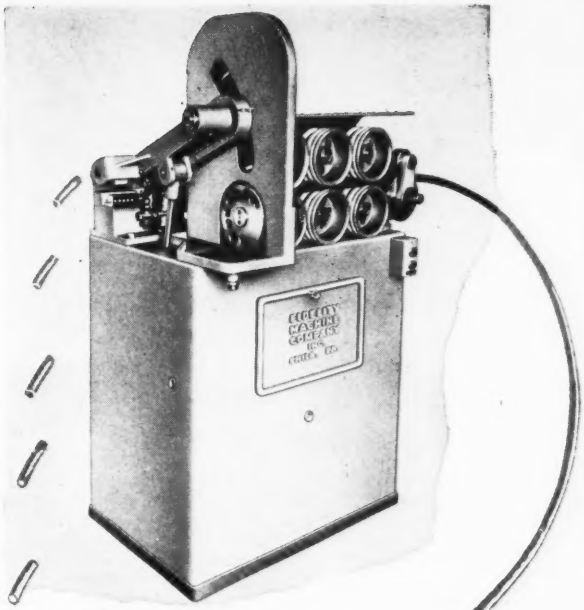
Universal Testing Machine

A NEW type of universal testing machine that incorporates an electric weighing system and electronically controlled, motor-driven loading mechanism has been announced by Baldwin-Lima-Hamilton Corp., Philadelphia, Pa. Designated the Model FGT Baldwin-Emery SR-4, the machine has a load capacity of 50,000 pounds. Features include accuracy and sensitivity corresponding to that of the best scales; high-speed response of indicator or recorder to both dynamic and static loads; extreme structural stiffness and lateral rigidity; loading speed range of 0.025-9.0 inches per minute under stepless control; automatic control for maintaining constant load or strain, or constant rate of loading or straining; single location of specimens for both tension and

(*Continued on page* 138)



Model FGT Baldwin-Emery SR-4 Universal Tester



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New Materials

New Vinyl Plasticizer

A NEW vinyl plasticizer, 0-16, is now commercially available from Rubber Corp. of America, 274 Ten Eyck St., Brooklyn 6, N. Y. Consisting of iso-octyl palmitate of high purity, the new product is soluble in most organic solvents, and is compatible with most natural and synthetic resins and rubbers except for water soluble polymers.

As a secondary plasticizer in polyvinyl chloride compounds, 0-16 adds anti-blocking properties and increases heat stability by functioning as an internal lubricant. The plasticizer is also said not to show the tendency toward discoloration and rancidity exhibited by esters of unsaturated fatty acids. In vinyls, 0-16 is usually used to replace 10-15% of the other plasticizers in the compound. In organosols and plastisols, 0-16 reduces initial viscosity and tends to increase the viscosity stability upon storage. The material is also suggested for use in nitrocellulose and synthetic rubbers.

A clear liquid with a mild odor, 0-16 has a specific gravity of 0.863±0.003; maximum acidity of 0.2%; and maximum moisture content of 0.05%. Other properties include: mid-boiling point at 5 mm. pressure, 228° C.; distillation range at 5 mm. pressure, 218-235° C.; flash point, 415° C.; freezing point, 6-9° C.; viscosity, 22 centipoises at 25° C.; and weight per gallon, 7.19 pounds at 20° C.

New Pliovic Resin

THE first in a new series of Pliovic polyvinyl chloride resins has been announced by the chemical division of Goodyear Tire & Rubber Co., Akron, O. Designated as Pliovic G90V, the product is described by Division Manager H. R. Thies as a general-purpose, straight vinyl material having an approximately intrinsic viscosity of 0.90-centipoise. Outstanding thermal stability of the resin is the basis for its recommendation for universal use in calendering, extruding, injection molding, and compression molding. Both clear and pigmented products are said to benefit from the excellent light stability and good color of the resin. Other advantages include a high bulk density for ease of handling, and ready interchangeability with other general-purpose vinyl resins.

The new material is expected to find its most extensive use in the calendering of film and sheeting for rainwear, draperies, upholstery, and similar products. Plant and laboratory tests have shown that products made with Pliovic G90V exhibit low water absorption, relatively good flexibility at low temperatures, and exceptional clarity in unpigmented compounds.

Silicone Blowing Agent

A NEW specialty silicone chemical, silicon oxyhydride, with outstanding properties as a filler and blowing agent for rubber, has been developed by Linde Air Products Co., Division of Union Carbide & Carbon Corp., New York, N. Y. Under the influence of heat or chemical agents, one gram of silicon oxyhydride can liberate 423 cubic centimeters of hydrogen gas to produce a porous foam structure in natural and synthetic rubber gum stocks during conventional curing operations. The residual solid is an effective silica filler of the type normally employed to impart mechanical strength to rubber.

The new chemical also possesses properties of interest for other types of industrial uses, such as a waterproofing component for greases, creams, and similar materials; a catalyst base; a chemical reducing agent; and a source of silicon sesquioxide.

"**Lustrex Latices**—Polymerized Styrene Resin Dispersions." Production Information Bulletin No. 58. Monsanto Chemical Co., Springfield 2, Mass. 16 pages. Detailed information and test data appear on the stability, compounding, properties, and applications of Lustrex Latices, a series of aqueous dispersions of styrene resins supplied in both plasticized and unplasticized forms. Uses include protective coatings, adhesives, laminates, wax additives, rubber latex modifiers, and others.

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Ames No. 2 is a compact bench model dial comparator for measuring sheet metal, glass, hard rubber. *Ames No. 2W* is similar, but is furnished with dead-weights and contacts to ASTM specifications for checking textiles, plastics, sheet rubber, etc.

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Ames No. 130 is designed especially for inspecting comparatively large and odd-shaped parts. For this reason, the flat-ground steel base, the adjustable indicator support, and the upright column are proportioned to the user's requirements.

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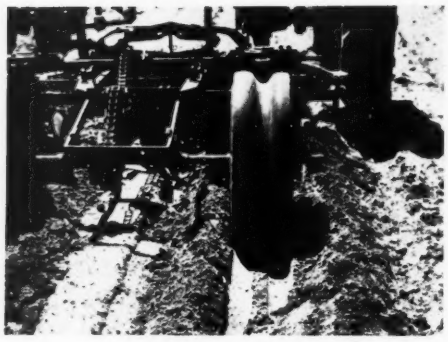


Track of New Tubeless Pneumatic Planter Tire

Goodrich Tubeless Farm Tire

A NEW tubeless pneumatic planter tire has been developed by The B. F. Goodrich Co., Akron, O. This tire has a low section with an overall diameter of 20 inches and is mounted on the popular sized 15-inch passenger-car rim. The tire operates at low inflation pressures ranging from four to eight pounds of air. Designed as a press wheel for use on corn and cotton planters, to replace steel wheels, the tire has been tested in corn and cotton growing areas throughout the country with excellent results.

New-Style Plastic Raincoat

Silhouette Raincoat Uses Velon Plastic

HIGH fashion styling and the practical features of vinyl plastic are combined in the Silhouette raincoat introduced by Hygrade Novelty Mfg. Corp., New York, N. Y. Designed by Ernst Engel and made of six-gage Velon film, produced by Firestone Plastics Co., the coat has fashion features and draping qualities never before available in plastic, it is claimed. Water repellent cotton fabric trim in navy, brown, gray, green, or red is used to accent the frosty translucent Velon in the snug fitting standing collar, front facing, pocket flaps, armhole trim, and elasticized push-up cuffs. The coat is cut with full back flare and deep raglan sleeves for easy fit over all cnstumes. All sleeves and pockets are electronically sealed, and there are no side or back seams in the coat. The front and pocket flaps have snap fasteners.

Firestone Tubeless Passenger-Car Tire

A NEW tubeless passenger-car tire of low-pressure super-balloon construction, with an inner lining that provides puncture and blowout protection, is being marketed by the Firestone Tire & Rubber Co., Akron, O. This tire is said to incorporate race-tire construction principles and has the latest non-skid design with specially cut traction slots in the silent running tread. The tire, it is claimed, has successfully passed outdoor road tests at sustained speeds well above 110 miles an hour, without the violent distortion in the tread that causes premature tire failures.

Giant-Size Flexible Tubing

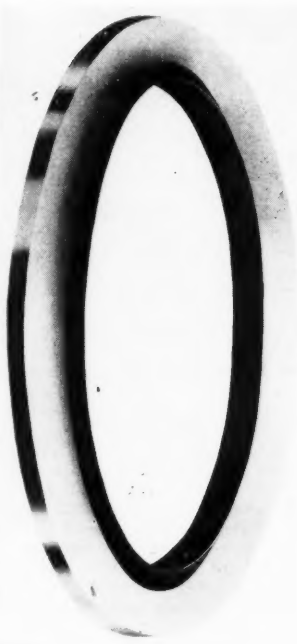
Spiratube Enclosure Said to Be the Largest Piece of Flexible Tubing Ever Made

A GIANT Spiratube, said to be the largest piece of flexible tubing ever made, has been manufactured by Flexible Tubing Corp., Guilford, Conn., for use in the development laboratories of General Electric Co.'s air conditioning division at Bloomfield, N. J. The tubing, seven feet in diameter and 122 inches long, will be used by G-E as a psychrometric calorimeter to test self-contained air conditioners in the 3-10 horsepower range.

In use, the upper end of the Spiratube is secured to the test room ceiling. The air conditioner to be tested is installed underneath, and the Spiratube enclosure is then lowered and secured to the floor to form an enclosed room around the conditioner. Warm, moisture laden air is forced through an opening in the enclosure's side, circulated around and into the air conditioner, cooled, and then drawn off through ductwork in the ceiling. Temperature and humidity readings are taken of both incoming and outgoing air.

The lightweight, easily retractable Spiratube enclosure is made of neoprene impregnated duck supported by spring wire 0.244-inch in diameter. The side opening, two feet high and three feet wide, is framed with aluminum for greater strength. The enclosure and accompanying equipment permit G-E engineers to account for more than 98% of the heat and moisture entering the air conditioner being tested.

Improved Rubber Sealing Member



Dyna-Seal Rubber-Metal Sealing Member

DYNA-SEAL, a face-to-face sealing member for use on flat surfaces, bolt heads, rivet heads, flanges, and special fittings, has been announced by Precision Rubber Products Corp., Dayton, O. The product consists of a synthetic rubber sealing member bonded to a steel ring, requires no grooves, and seals all pressures against water, all types of petroleum products, and many other fluids and gases.

The rubber member is so shaped that pressure directed radially outward serves to force the seal more securely against the abutment faces to form a leakproof seal that becomes tighter as the pressure increases. Pulsating pressures cause a dynamic flexing action that assures a positive seal at all times. Other advantages of Dyna-seal include one-piece assembly to provide accuracy of location; possible re-use; full bearing surface under both standard and special designs of bolt and rivet heads; lock washer action under conditions of vibration; sealing up to pressures of 10,000 p.s.i.; and a service temperature range of —65 to +250° F. Standard Dyna-seals are available in outside diameters ranging from 0.422-1.844 inches; inside diameters of 0.220-1.175 inches; and thickness of 0.054-0.090-inch.

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POLYCOS 296 and 296N

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For complete information and data, write for Bulletin P-27.

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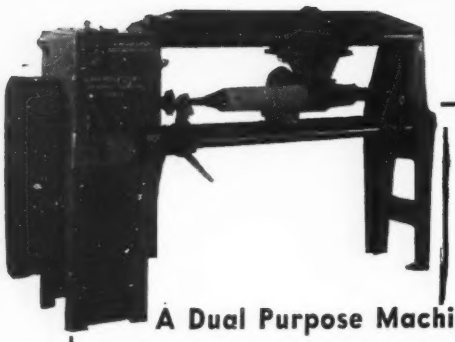

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Survey of Rubber Derivatives

Communication No. 179, Rubber Stichting, Delft, entitled "Developments and Possibilities in the Field of Rubbber Derivatives," by G. Salomon, presents a survey of the chemical, macromolecular, and technological aspects of derivatives of natural and synthetic rubbers. The relation of structure and reactivity of rubbers is discussed as observed in three types of addition reactions: polar addition and substitution addition; radical initiated addition and reactions of oxygen and sulfur.

In polar reactions there is a clear connection between the rate of addition of acceptor molecules at the double bond and the availability of pi-electrons. A table is given in which six groups of rubbers, natural and synthetic, are arranged in the order of the reactivity of the double bonds with perbenzoic acid at 0° C. Neoprene (I) here proves the least reactive; the "internal" double bonds of polybutadiene-based rubbers (III) are 20 times as reactive as the "external" vinyl groups (II); "isorubber" (IV) is somewhat more reactive than (III), but is about eight times less reactive than the polyisoprenes (V) (including natural rubber and gutta percha); methyl rubber (VI) is about half as reactive again as (V).

The same order of reactivity is observed in other polar reactions.

Discussion of chlorination reactions is preceded by a brief explanation of a type of polar reaction in which rubber chains of the (V) and (VI) type, and to a lesser degree also (III), undergo "internal" polymerization in the presence of polar catalysts, identical to the conversion of aliphatic to cyclic terpenes. Intermediate formation of tertiary carbonium ion takes place with subsequent, not easily predictable, migration of the double bond. It is shown that intermediate formation of carbonium ion also takes place during direct chlorination of natural rubber, giving rise to the allyl chloride; continued chlorination eventually leads to addition of chlorine at the double bond also. Since cyclization occurs during chlorination, chlorinated rubber is actually a complicated mixture of cyclic and aliphatic polychlorides.

Also classed as polar additions are the thermal substitution additions of maleic anhydride and of other dienophiles (at 150° C.), which are closely related to the preceding chlorination reactions.

The reactivity of double bonds to free radicals is not so readily predictable as the foregoing reactions; in many cases synthetic rubber reacts as well, if not better than natural rubber.

Attention is called to the addition of dienophiles to natural rubber in the presence of free radicals, at low temperatures, when saturated, six-membered rings are formed, in marked contrast to the thermally produced adduct of maleic anhydride and natural rubber which retains both the unsaturation and chain structure of the rubber.

The additions of SO_2 and of the R-SH compounds are also discussed; in connection with the former, the preparation of a new fiber based on the natural rubber-SO_2 adduct, developed by de Xie and collaborators, is cited.

Turning to oxygen and sulfur reactions, it is pointed out that although the formation of oxygen-containing rubber derivatives is essentially a polar addition reaction, radical initiated reactions may cause a fundamental change in the structure of the macromolecule during preparation of the derivative. Reference is made to the discovery of six-membered cyclic natural rubber-peroxides by Bollard and co-workers.

Reactions of sulfur and rubbers cannot yet be definitely classified, but the properties of hard rubber suggest the preponderance of cyclization reactions here.

In the discussion of the relation between structure and mechanical properties of rubber derivatives, it is recalled that practically all known rubber derivatives are amorphous polymers; very few conversion products of natural rubber are crystalline. Mechanical properties of the amorphous products depend essentially on four structural factors: ring formation, polar groups, bulkiness of groups, and double bonds.

Only three groups of natural rubber derivatives show crystallization—the hydrochlorides of natural rubber and gutta percha; natural rubber and gutta percha complexes with silver salts; oriented rubber—SO_2 adducts; they have high modulus and favorable tensile properties, owing to the crystalline phase. In this connection it was shown that a regular structure of the

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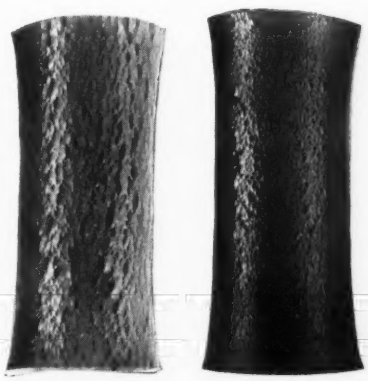
In natural rubber—Unprotected Compound A started to crack in 5 hours. Compound B, containing 1½ parts of Santoflex B on 100 parts of rubber hydrocarbon, ran 23 hours before cracking. Test continued for 214 hours.



In GR-S (LTP)—Compound A, unprotected, started cracking in 16 hours. Compound B, containing 1½ parts of Santoflex B on 100 parts of GR-S, did not crack until 43 hours. Test was run a total of 140 hours.

Samples were flexed in an ozonized chamber using the standard test atmosphere of 25 parts ozone per 10^8 parts air.

Specifications

	Appearance	Ash	Insolubles (benzene)	Specific Gravity
SANTOFLEX B 1,2-dihydro-2,2,4-trimethyl-6-phenylquinoline	Dark, waxy lumps	0.1% max.	Trace max.	1.11 @ 25° C.
SANTOFLEX BX Blend of 85 parts Santoflex B and 15 parts N,N'-diphenyl-p-phenylenediamine	Dark, waxy lumps	0.3% max.	1% max.	1.12 @ 25° C.
SANTOFLEX 35 Blend of 65 parts Santoflex B and 35 parts N,N'-diphenyl-p-phenylenediamine	Dark, waxy lumps	0.5% max.	1.5% max.	1.14 @ 25° C.

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A-77*
A-100

MERCAPTO ACCELERATORS
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El-Sixty*
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Mono Thiurad (Tetramethylthiuram monosulfide)
Methasan* (Zinc salt of dimethyl dithiocarbamic acid)
Ethasan* (Zinc salt of diethyl dithiocarbamic acid)
Butasan* (Zinc salt of dibutyl dithiocarbamic acid)

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polyolefin it essential for the formation of a crystalline rubber derivative.

Methods of preparing modified rubbers—from solid rubber, from rubber solutions and from latex—the products obtained, and their economic and technological advantages are next treated. Van Amerongen's method of chlorinating stabilized natural rubber latex in acid medium, and vanVeersen's process for hydrochlorinating stabilized natural rubber latex with HCl gas, are mentioned.

As to the outlook for the future, no surprises are expected unless new and economically attractive aspects show up in olefin chemistry. New applications may be found for chlorinated rubber, ebonite, and more especially for hydrochlorinated rubber; thermally degraded rubber is considered to have some slight possibilities and perhaps also the natural rubber-hydrogen peroxide adduct because of its adhesive properties. Developments now under way aim at incorporating rubbers in brittle polymers and at reinforcing rubbers by organic fillers.

Rubber Stichting Meetings

Representatives of eight West European countries met on June 30, at the Rubber-Stichting, Delft, to discuss further details in regard to the establishment of mutually recognized diplomas in the rubber field. The fundamental idea was that each country would award its own diploma, and that the diploma would represent the same standard of attainment as the Licentiateship Diploma of the Institution of the Rubber Industry. It was revealed at the meeting that some countries have already started a suitable training scheme; while others would require more or less prolonged periods of preparation first. France presented a special problem since she has for some years been operating a system recognized by the French Government so that it would be necessary to find a way of incorporating the new project into existing arrangements.

From July 1 to 4 a technical-scientific conference was held at the Rubber Stichting which was attended by about 120 experts from various West European countries. The talks reviewed the scope and aims of the Rubber Stichting and progress in testing methods and in different lines of Industrial research in the rubber industry.

FAR EAST

MALAYA

Japan Complains about Malayan Rubber Quality

Japanese rubber importers have been complaining that raw rubber received from Malaya is frequently not up to RMA specifications and was sometimes even two grades lower. Action is to be taken by Japanese rubber importers' and manufacturers' associations to get permission to station representatives in Singapore to inspect the raw rubber before shipment to Japan.

In Singapore it was admitted that there had been some bad shipments to Japan, but it is at the same time pointed out that Japanese have been buying rubber at two to three cents (Straits) below normal prices, and this fact is held partly responsible for the inferior rubber sent.

The director of Kasho Co., Ltd., Tokyo, Japan's biggest rubber importer, visiting Singapore on a business survey, stated that Japan was ready to buy all her rubber needs of 5,000 tons a month in Malaya provided the quality was dependable. Malayan rubber was preferred to Indonesian, but at present the latter was dependable in quality and cheaper. He intimated that for these reasons more rubber might be bought from Indonesia although shipment from that area took two to three times longer than from Malaya.

From another source it is learned that Japan recently completed a new trade agreement with Indonesia whereby she will receive about 24,000 tons of rubber and 500 tons (dry rubber content) of liquid latex during the twelve months ending July, 1953.

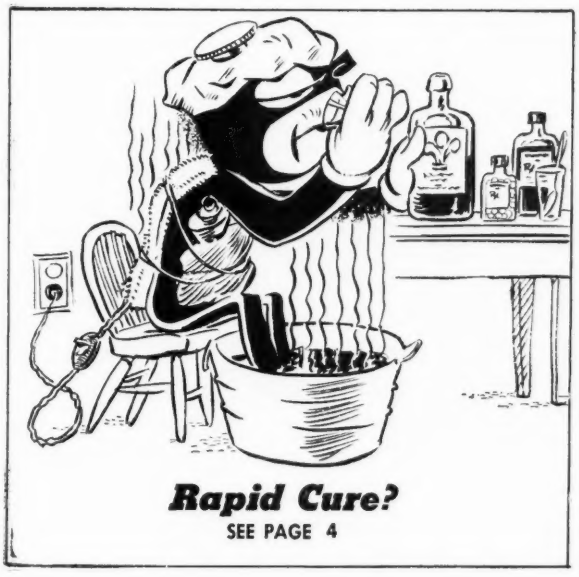
Malayan shipments to Japan during 1951 came to 30,510 tons, and to 25,262 tons in the first seven months of the current year.

To Strengthen the Rubber Industry

Malayan rubber circles have noted with much satisfaction the positive steps made in late August and the beginning of September by the government to strengthen the industry. On September 1 the first effective measures were taken to get the government's ambitious replanting scheme working. On that day application forms for financial aid were made available to all smallholders who had, on their own initiative, already begun to fell their oldest rubber trees and to clear the land for replanting. Under an interim scheme of financial assistance and encouragement—pending a detailed scheme expected to go into operation early next year—such smallholders are to get $120 (Straits) for each acre they will replant. When it is considered that the present cost of replanting runs around $600 (Straits) an acre, it will be seen that the sum allotted is modest enough. The undertaking, however, is a vast one that will heavily tax the financial resources of the country; the first part of the plan alone provides for replanting 500,000 acres of the oldest rubber by 1959, at an estimated cost of $300,000,000 (Straits). Besides the problem of financing the scheme, there will be the additional one of developing the nurseries to provide the large amount of high-grade material required for replanting on the proposed scale.

The government is also concerning itself with the question of improving the product to put it in a better position to compete with synthetic rubber. The Federal Member for Economic Affairs toward the end of August decided to call a meeting to discuss government proposals for the formation of a Pan-Malayan body to improve the quality of Malayan rubber.

Discussing the projected meeting and its aims editorially, the *Straits Times* of August 27 concedes the value of steps to improve quality, to maintain consistent quality, and to maintain strict control over packing, if Malayan rubber is to compete successfully with synthetic rubber; but stresses that this is only one way of meeting the situation. There is no reason why bad rubber should be produced or exported from Malaya, and if further legislation is needed to prevent this situation, it should be unhesitatingly applied, it adds. While admitting that smallholder rubber offers the greatest scope for improvement in quality, the editorial criticizes the lack of efficiency among many estates. Leaders of the industry constantly assert that there is nothing the natural rubber industry wants more than the opportunity to compete on equal terms with the synthetic product, but, asks the paper, is the estate side of the industry really properly organized to compete with synthetic even if its price were on a true commercial basis? There are still hundreds of British-owned estates in Malaya, it continues, some of less than 2,000 acres, each separately owned and directed from London, "overweighted with administrative costs." This state of affairs is hardly "the right kind of set-up to aspire to successful competition with a virile young industry, backed by some of the best commercial scientists and technicians in the world, which, when it ceases to be a government enterprise, will probably be concentrated in the hands of a comparatively few highly efficient companies." As the *Straits Times* sees it, a partial remedy is amalgamation.



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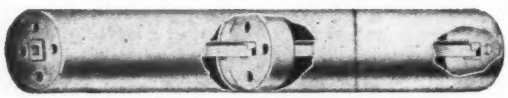

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Two Rubber Companies Moving to Africa

A leading Edinburgh newspaper recently commented on a "growing trend" among Malayan rubber companies to transfer operations to less troubled areas and mentioned two instances, Aberfoyle Plantation, Ltd., and Kepong (Malay) Rubber Estates.

The directors of Aberfoyle, it was pointed out, had decided to acquire 5,000 acres in Southern Rhodesia to develop a tea garden. Shareholders were told that in view of the unrest and disturbed conditions in Malaya, it was considered advisable for the company to have other interests outside the country, and that the decision to choose tea instead of rubber was taken after very careful thought. Toward the end of last year nine rubber estate companies of the "E. B. Ridsdel" group of companies merged with Aberfoyle, which now has a capital of £235,494, on which an interim dividend of 20% was paid for the year ended March 31, 1952.

The decision by Aberfoyle came after the announcement by the chairman of Kepong Rubber Estates that, in cooperation with three other companies, it had obtained a lease of 12,500 acres in Nigeria to plant rubber; he added that "today it is virtually impossible owing to labor and other difficulties to plant any large areas in Malaya."

All this was reported in a recent issue of the *Malay Mail*, and leading rubber estate agencies in Kuala Lumpur promptly denied there was any move to leave Malaya.

A Harrison & Crosfield representative stated, "We have not the slightest intention of moving any of our rubber companies from Malaya. We have full confidence in the future of Malaya and have never considered the matter of moving out."

He added that companies associated with the group were going ahead with replanting and new planting programs in full confidence of the future. Other leading agency houses expressed similar opinions. An official of the United Planting Association of Malaya said there had been a certain amount of loose talk about the possibility that Malayan rubber estates might have to look to Africa for reinvestment of their money. But he had heard of only two factual cases (those mentioned above) of opening up in Africa. The talk was due not only to the emergency, but to the difficulty of getting new land in Malaya.

Whatever the facts of the case, it may be mentioned that about 50,000 acres of European rubber lands have been transferred to Chinese companies within the last few years.

The Rubber Market

Singapore rubber circles welcomed the recent Washington announcement that the price of government-produced butadiene would be raised to 18¢ (United States) a pound, 5¢ more than privately manufactured butadiene—as a step in the right direction toward fairer competition between synthetic and natural rubber.

Curiously enough the news, instead of raising prices on the Singapore rubber market, depressed them. The reason for this unexpected effect seems to have been a misunderstanding by the Chinese press which reported that the price of synthetic rubber was to be reduced from 23¢ (U. S.) to 18¢ a pound, which led to a rush by up-country producers to sell accumulated stocks.

The market, which had been steady enough for several weeks, suddenly deteriorated at the end of the third week of August; on September 5 prices dropped to 75¾ cents a pound for September first-grade rubber in Singapore—the lowest price since just before the outbreak of the Korean war. At one stage it was down to 75¼ cents a pound, and might have fallen still lower, but for the fact that August imports at 25,499 tons showed a drop of more than 9,500 tons, as compared with the July figure.

Up-country selling by producers was in some quarters held responsible for the sudden break in the market; it was the opinion that the selling was a reaction to the inconclusive results of the London talks of the International Rubber Study Group Working Party. Holders of stocks, it was said, kept off the market during the talks in expectation of a favorable price agreement and then promptly threw their rubber on the market when they were disappointed in their hopes.

In this connection it may be well to quote from the Market Report for September 5, issued by United Baltic Corp., Ltd., Mincing Lane, London, which suggested:

"A more pertinent reason has undoubtedly been that although there has been some consumer demand, it has not been enough to move near rubber in sufficient volume to prevent the accumulation of stocks in the East, particularly of the midde grades of R.S.S."

(*Continued on page* 138)

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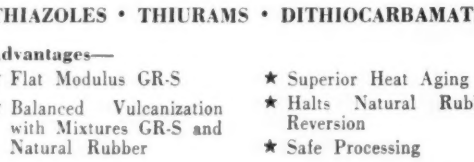

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Editor's Book Table

BOOK REVIEWS

"Pressure-Volume-Temperature Relationships of Organic Compounds." Robert R. Dreisbach. Third Edition. Handbook Publishers, Inc., Sandusky, O. Cloth, 11 by 8½ inches, 314 pages. Price, $10.

This reference manual presents comprehensive and accurate tabular data on the vapor pressure-temperature and latent heat of vaporization values of 23 families of organic compounds, including aliphatic and aromatic hydrocarbons, alcohols, esters, ethers, amines, ketones, and others. The values in each table begin with the boiling point of the lowest member of the family, extend above the boiling point of the highest boiling member, and cover pressures from 760-0.1 millimeters of mercury. In addition to direct tabulations of boiling points, latent heats of vaporization, and flash points of the compounds, the manual gives simple equations for obtaining accurate values of the rate of change of boiling point with pressure; orthobaric vapor densities and volumes to a reduced temperature of 0.92° C.; densities of various liquids at different temperatures; critical temperatures of polar and non-polar compounds; and checking the accuracy of density and refractive index determinations of liquids. Similar data for compounds not belonging to any of the families covered can be obtained by referring to the table for the nearest related family. The tables have been used in the laboratories and plants of Dow Chemical Co. and will be of great value to chemists and engineers concerned with pressure, temperature, and volume relationships of liquid or vaporized organic compounds.

"Technical Reporting." Joseph N. Ulman, Jr. Henry Holt & Co., Inc., 383 Madison Ave., New York 17, N. Y. Cloth, 6½ by 9¼ inches, 303 pages. Price, $4.75.

This volume gives extremely practical information on how to convey information and ideas accurately and efficiently in the technical field. Major emphasis is placed on preventing one of the commonest and most serious faults in technical writing, the burying of important ideas under a mass of detail. Accordingly, the author discusses only the principles that are most overlooked by technical writers and does not give a comprehensive academic treatment of grammar and punctuation rules other than those which can be easily remembered by general rules of thumb. Clarity and understanding of the principles discussed are enhanced by the inclusion of many passages taken from technical papers or reports, with the author giving both the original example and suggested revision in each case.

The first portion of the book covers basic issues, including the importance of proper technical reporting, fundamental principles, and general procedure for preparing a report. Different forms of reports, including laboratory, formal, informal, and oral, and technical papers, are described in the second part. The third and concluding section deals with writing style, grammar, punctuation, mechanics, use and preparation of tables, and visual presentation of information. An appendix gives standard abbreviations for technical terms; specimens of different types of reports; and a bibliography for further reading. A subject index is also included.

NEW PUBLICATIONS

'ARCC Resin Emulsions—Tackifiers and Reinforcers for Compounding Natural and Synthetic Rubber Latices." Technical Data Sheet A-42. American Resinous Chemicals Corp., Peabody, Mass. 4 pages. Information is supplied on the properties, blending, and applications of the company's resin emulsion tackifiers and reinforcers for natural rubber, neoprene, and GR-S latices.

"U. S. Electrical Wires and Cables." United States Rubber Co., Rockefeller Center, New York 20, N. Y. 186 pages. This general catalog describes the construction and operating characteristics of more than 500 different types of wires and cables made by the company. A detailed engineering data section is also included.

"Carbon Black Pigments." Vol. II, No. 6, revised June, 1952. Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass. 16 pages. This report covers Cabot blacks for the paint, ink, plastics, and paper industries. In addition to descriptions of the various blacks, information is given on their physical, chemical, and electrical properties; testing procedures used; and packing data.

"B. F. Goodrich Industrial Tire Guidebook for Users of Materials Handling Equipment." B. F. Goodrich Co., Akron, O. 12 pages. The features and applications of the company's industrial tires are described in this illustrated booklet. Information on maintenance is also given, and there is a table of material densities to aid in determining unit loads.

"Styrofoam, A Better Insulation for Low-Temperature Applicatons." Dow Chemical Co., Midland, Mich. 26 pages. In addition to providing data on the properties of Styrofoam polystyrene foamed material, this illustrated booklet discusses methods for installing the material on various surfaces; tells how to apply adhesives and finishes; and gives data on several low-temperature applications.

"Staycin 1, A Stabilizer Designed to Inhibit Plasticizer Exudation." Baker Castor Oil Co., 120 Broadway, New York 5, N. Y. 4 pages. Information has been prepared on the composition, properties, and applications of Staycin 1, a complete stabilizer for polyvinyl resins which contain oil-type plasticizers. The product stabilizes against heat degradation, light attack, and plasticizer exudation and also lubricates the compound during processing.

"Dry Blending Monsanto Opalon 300 in the Manufacture of Extruded Products." Production Information Bulletin No. 79. Monsanto Chemical Co., Springfield, Mass. 19 pages. A comprehensive outline of the various dry blending techniques applicable to Opalon 300 polyvinyl chloride resin appears in this bulletin. Laboratory-scale blending, formulations, coloring, and extrusion of dry blends are also discussed.

"Low Brittle Point Neoprene Compounds That Are Fungus Resistant." BL-247. E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 4 pages. Information is given on the processing and properties of compounds using combinations of Neoprene Types W and GN with Type S. These stocks are smooth processing, fungus resistant, and have brittle points below —67° F.

"The Neoprene Notebook." No. 51, July, 1952. 8 pages. This issue of the "Notebook" contains the first of a two-part discussion of cellular rubber products and differentiates between the three types of cellular rubbers. Other stories cover the use of neoprene in terminal blocks, jacketed underground cable, barrel lining for tumbling drums, and floor joint putty compounds.

Publications of General Tire & Rubber Co., Akron, O. **"Kalabond Rubber-to-Metal Adhesive."** 8 pages. Kalabond, a halogen-free adhesive that gives bonds having excellent resistance to solvents, corrosion, aging, and shock, is described in this booklet. Typical test data are shown for bonds with natural rubber, GR-S, Hycar, and neoprene.

"Ko-Blend I.S., A Latex-Compounded Masterbatch of Insoluble Sulfur." 4 pages. This booklet deals with the advantages and applications of Ko-Blend I.S., a latex masterbatch of 85% insoluble sulfur and a GR-S type rubber. Advantages include sulfur bloom control, elimination of stock discoloration, reduction of scorch and milling time, good dispersion, and control of green tack.

Publications of Thiokol Corp., 780 N. Clinton Ave., Trenton 7, N. J. **"Thiokol Liquid Polymer LP-2."** 4 pages. Information is given on the properties, compounding, curing, and uses of LP-2, a liquid polysulfide polymer. Applications illustrated and discussed include impregnations, protective coatings, binders, sealants, filletings, rubber repair and patching materials, and caulking compounds.

"Natural Rubber and GR-S Compounds Having Excellent Low-Temperature Flexiblity Utlizing Thiokol Plasticizer TP-90B." Technical Service Bulletin No. 110. 1 page. Typical formulations utilizing TP-90B are shown for natural and GR-S rubber compounds having low-temperature flexibility.

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"Machinery for Processing Rubber and Plastics." Catalog 52. Stewart Bolling & Co., Inc., 3190 E. 65th St., Cleveland 27, O. 64 pages. This new catalog illustrates and describes the company's main types of rubber and plastics processing equipment, including intensive mixers, calenders, crackers, mills, refiners, presses, bale splitters, vulcanizers, and speed reducers.

"Vinylite Resin VAGH for Coatings—Properties and Uses." Technical Release No. 6. Bakelite Co., Division of Union Carbide & Carbon Corp., New York, N. Y. 15 pages. Detailed information appears on the properties of Vinylite Resin VAGH, a modified vinyl chloride-acetate copolymer recommended for use in paints, industrial coatings, and adhesives. Application discussions include typical formulations and properties obtained.

'19 Steps to Better Extruding and Straining." National Rubber Machinery Co., Akron 8, O. 16 pages. The manufacture and the design of extruder or strainer feed screws are described and illustrated in this booklet. Included are equations for calculating the compression ratio, mechanical efficiency, and single flight volume of a screw.

"1952-53 Year Book." The Tire & Rim Assn., Inc., Akron, O. Price, $3. 188 pages. **"Bi-Monthly Supplement to All Lists.** June, 1952." Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago 11, Ill. **"Bonding Procedures."** National Brake Block Corp., New York, N. Y. 8 pages. **"Conformability of Rubber and Similar Substances."** J. Bekk; translated by J. M. Fetsko. National Printing Ink Research Institute, Bethlehem, Pa. 10 pages. **"Alkathene Film for Drum Lining."** Imperial Chemical Industries, Ltd., Welwyn Garden City, Herts., England. 15 pages. **"British Standard Methods of Testing Raw Rubber and Unvulcanized Compounded Rubber.** Part I. Sampling." British Standards Institution, London, England. 8 pages. Communications of Rubber Stichting, Delft, Holland: No. 172. **"Patents on the Manufacture of Heat-Sensitized Latex."** 16 pages. No. 173. **"Patents on the Manufacture of Sponge and Foam Rubber from Latex."** 70 pages. No. 174. **"Patents on the Manufacture of Dipped Articles from Latex."** 88 pages.

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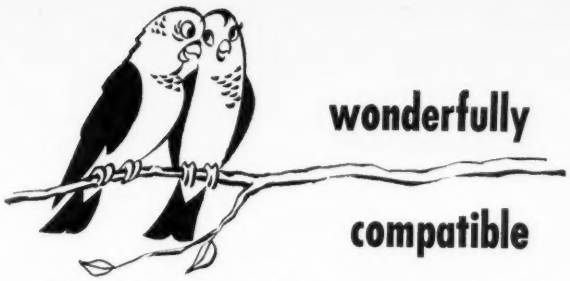

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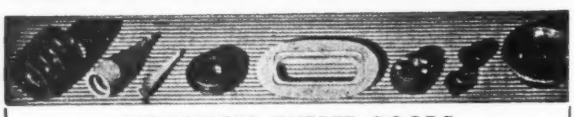

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A personal discussion of your problems is suggested.
29 W. 15th St., New York 11, N. Y. WA 4-8800

Synthesis of Derivatives of 4,5-Dimethyl-2-Mercaptothiazole. F. D. Stewart, R. A. Mathes, *J. Org. Chem.*, 14, 111 (1949).

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Thiocarbamylsulfenamides. G. E. P. Smith, Jr., G. Alliger, E. L. Carr, K. C. Young, *J. Org. Chem.*, 14, 935 (1949).

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Testing Machine

(*Continued from page* 123)

compression tests; automatic reversing of load; semi-automatic operation for production work; and adaptability to stress analysis of parts.

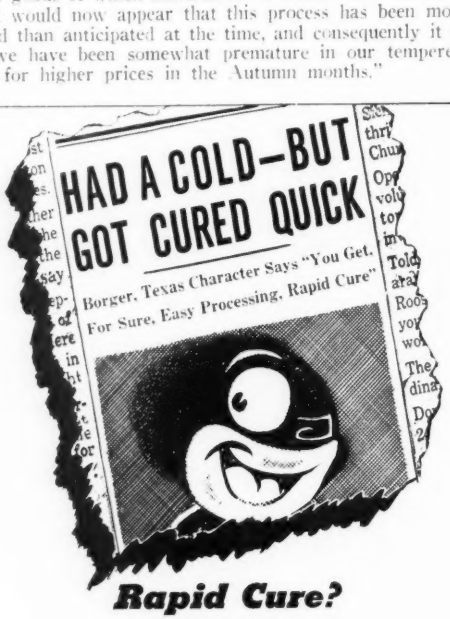
Loads are measured by means of two SR-4 universal load cells, each of 30,000 pounds capacity. Three load ranges, 0-50,000 pounds, 0-10,000 pounds, and 0-2,000 pounds, are provided on a separate indicator with a 24-inch diameter dial. Lower ranges are available by fitting a detachable SR-4 load cell on the crosshead and connecting it into the load indicating dial. The test table is 20 inches square; maximum vertical space is 24 inches; clearance between columns is 21 inhes, and maximum stroke is eight inches. Optional accessories include automatic equipment for printing extension or strength values.

Malaya

(*Continued from page* 132)

The report concludes:

"Some months ago we referred to the accumulation of finished rubber goods of which manufacturers found it difficult to dispose, and it would now appear that this process has been more protracted than anticipated at the time, and consequently it may be that we have been somewhat premature in our tempered optimism for higher prices in the Autumn months."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Borger, Texas Character Says "You Get. For Sure, Easy Processing, Rapid Cure"
Rapid Cure?
SEE PAGE 4

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EXECUTIVE-RUBBER-CHEMICAL ENGINEER DESIRES TO RELocate. Proven factory manager and technical director. Over 20 years' experience management, selling, research and development compounding, production, engineering design and costing of mechanical and chemical blown sponge rubber. Experience includes molded and extruded, special engineered mechanicals, drug sundries and automotive sponge and mechanical parts. Consulting and Manufacturer's Agent proposals will be given careful consideration. Address BOX No. 1142, care of INDIA RUBBER WORLD.

POSITION IN PRODUCTION OR FINANCIAL FIELD BY YOUNG technical administrator. B. S. degree Chemistry. Additional studies business organization and administration. Seven years' research and development experience in rubber field. Good record of supervision and administration. Desires broader range of experience. Address BOX No. 1143, care of INDIA RUBBER WORLD.

RUBBER EXECUTIVE AVAILABLE WITH 25 YEARS' EXPERIence in administrative capacity. As director of purchases for nationally known manufacturer thoroughly familiar with all phases of procurement including supervision of plant inventories, storage, receiving, and traffic departments. Location unimportant. Excellent references substantiate proven record of ability. Address BOX No. 1144, care of INDIA RUBBER WORLD.

OPERATIONS MANAGER, RESEARCH AND PRODUCT DEvelopment engineer, chemist, with 30 years' experience in application plastics, rubber, latex, fabric coating and allied fields. Diversified chemical, mechanical, and consulting experience. Patents registered. Available short notice. Address BOX No. 1145, care of INDIA RUBBER WORLD.

SALES MANAGER DESIRES CHANGE. PARTICULARLY INterested in the challenge of introducing new products. Many years' experience in the rubber and leather industries, selling to shoe manufacturers and other trades. Address BOX No. 1146, care of INDIA RUBBER WORLD.

PLANT SUPERINTENDENT, CHEMIST, 6 YEARS' EXPERIENCE in manufacture of rubber, vinyls, synthetic adhesives, combining cements. Can handle people. Resourceful, reliable, steady. Address BOX No. 1147, care of INDIA RUBBER WORLD.

LATEX CHEMIST INTERESTED IN RESEARCH AND DEvelopment. Ph.D. Over ten years' experience. Address Box No. 1161, care of INDIA RUBBER WORLD.

CHEMIST, B.S., 34 YEARS OLD, DESIRES TO RELOCATE. Factory and laboratory experience in production and factory processing, product specifications and quality control of rubber products. Address BOX No. 1164, care of INDIA RUBBER WORLD.

WANTED: POSITION WITH GREATER RESPONSIBILITY, ADvancement, and higher salary. Offer six years' experience research and development rubber and allied products, one year sales engineering. Rubber formulations all types synthetics, including latices. Considerable knowledge synthetic fabrics, adhesives, specialty rubber belting. B.S. degree Chem. Eng. A veteran. Presently employed supervisory capacity. Will consider sales, preferably New England. Exchanges mutually confidential. Address BOX No. 1165, care of INDIA RUBBER WORLD.

SITUATIONS OPEN

RUBBER TECHNOLOGIST — TECHNICAL SALES SERVICE. Large Eastern chemical manufacturer has technical sales service opening in synthetic rubber and rubber chemicals. Age 25 to 35. Several years' experience in rubber manufacture. College degree. Foreign languages, preferably German and French. Should be willing to make headquarters in Europe. Excellent opportunity in rapidly expanding field. Write giving in full detail age, education, and experience. Replies held strictly confidential. Our employes know of this ad. Address BOX No. 1148, care of INDIA RUBBER WORLD.

CHEMIST TO ASSIST PRODUCTION MANAGER IN EXPANSION program. Experience in molded and extruded rubber necessary. Medium-sized New England plant. Write full resume with salary required. Replies held confidential. Address BOX No. 1149, care of INDIA RUBBER WORLD.

RUBBER CHEMIST FOR SMALL NEW JERSEY MOLDED, EXtruded and lathe cut soft rubber plant. In excellent resort area location. Kindly furnish full particulars with application. Address BOX No. 1152, care of INDIA RUBBER WORLD.

RUBBER CHEMIST

Small, rapidly growing Ohio company offers excellent opportunity for rubber compounder. Heel and sole experience preferred. Salary open. Please furnish detailed résumé of work experience in first reply.

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Chemical Engineer or Chemist with experience in compounding and processing of synthetic and natural rubber. Position available requires this background to qualify for technical service and promotional activities with major chemical company servicing the rubber industry. Applicant with technical service experience is preferred—replies will be held strictly confidential.

ADDRESS BOX NO. 1141, c/o INDIA RUBBER WORLD

WORKS MANAGER, ESTABLISHED MANUFACTURER EASTern seaboard—350 employes. Extensive practical, shop, and supervisory experience—mechanical and/or molded rubber goods. Age: 35-45. Salary, $10,000 plus. Please submit detailed résumé. Address BOX No. 1150, care of INDIA RUBBER WORLD.

RUBBER TECHNOLOGIST — CHEMIST OR CHEMICAL ENgineer. Large eastern supplier has opening for permanent position in its rubber laboratory for recent college graduate with up to five years' industrial experience in mechanical goods, sundries, wire, tires, or latex. Practical experience in factory processing and compounding essential so that laboratory results can be readily interpreted and demonstrated to customers. Position offers excellent opportunities for advancement in either sales or development compounding. Progressive management encourages publication of experimental work. This, coupled with laboratory having finest equipment and staffed with highest type of trained technicians, assures successful applicant of ample opportunity to demonstrate ingenuity and ability. Position also offers opportunity for some travel and for contacts with the rubber industry. Write, giving in full detail, age, education, and experience. Replies held strictly confidential. Our employes know of this ad. Address BOX No. 1151, care of INDIA RUBBER WORLD.

TIME-STUDY MAN FOR NEW JERSEY PLANT, EMPLOYING approximately 125 people. Located in attractive resort area. Man must be able to assume responsibility for time study as well as for methods and similar allied jobs. Good opportunity for right man. Kindly furnish photograph along with application. Address BOX No. 1153, care of INDIA RUBBER WORLD.

WANTED: SUPERINTENDENT FOR BANBURY AND MILL DEpartment with experience to take full responsibility in Los Angeles plant. Excellent opportunity. Write giving full particulars and references. Address BOX No. 1154, care of INDIA RUBBER WORLD.

RUBBER CHEMIST—NEW ENGLAND MANUFACTURER OF rubber footwear has an opening for a rubber chemist, experienced in development and manufacturing. Must have complete knowledge of formulating compounds, factory processing, and laboratory control. Write giving detailed résumé, salary expected. Our staff has knowledge of this ad. Address BOX No. 1163, care of INDIA RUBBER WORLD.

MACHINERY AND SUPPLIES FOR SALE

FOR SALE: 1—BALL & JEWELL NO. 1½ ROTARY CUTTER, stainless steel. 3 Mikro pulverizers #1-SH, #2-SI, #2-TH. 2 Kux rotary pellet presses. 6 Stokes rotary pellet presses. Read 600-gal. jacketed ribbon mixer. Large stock stainless steel tanks and kettles. PERRY EQUIPMENT CORP., 1424 N. 6th St., Philadelphia 22, Pa.

FOR SALE: 1—SZEGVARI ATTRITOR TYPE B, 60 GALS., 5 H.P. —s/s. 1—Ball & Jewell #1 rotary chrome plated cutter. 1—Abbe Eng. #0 rotary cutter. Address BOX No. 1156, care of INDIA RUBBER WORLD.

CAMELBACK EQUIPMENT NEVER PUT INTO OPERATION— Complete production set up for making camelback consisting of 6" National Tuber and camelback head, 70 KW MG set, 100 h. p. Westinghouse motor, Dean Hill pump with strainer and spray nozzles, and camelback conveyor system. THE NYE RUBBER CO., Barberton, Ohio. Sherwood 1184.

FOR SALE: NEW LABORATORY MILLS AND CALENDERS, also used Banbury Mixers, Mills, Calenders, Extruders, Tubers, Hydraulic Presses, Vulcanizers. Send us your inquiries. EAGLE INDUSTRIES, INC., 112 Washington Street, New York 6, N. Y. DIgby 4-8364.

HAVE UNIT two 50" mills with drive and motor. Desirous of selling off foundation.

Address Box No. 1118,
c/o INDIA RUBBER WORLD

MARKET REVIEWS

RUBBER

ACTIVITY in the natural rubber market, both in spot and futures, was irregular during the period from August 16 to September 15. Prices showed a fairly steady decline in the primary markets, both here and abroad, owing to liquidation of upcountry stocks and poor trade support. There was some improvement in factory buying during the first half of August, but most purchases were centered on the lower grades which can compete with synthetic rubber on a price basis. Offerings on the spot market were said to be plentiful, but evoked little interest except after price declines.

NEW YORK SPOT MARKET
WEEK-END CLOSING PRICES

	July 26	Aug. 23	Aug. 30	Sept. 6	Sept. 13
R. S. S.: #1	30.75	30.75	28.00	28.50	28.00
2	30.25	30.25	27.50	27.75	27.25
3	29.25	29.25	26.50	27.00	26.50
Latex Crepe:					
#1 Thick	39.25	39.50	38.50	38.50	38.00
#1 Thin	39.25	39.50	38.50	38.50	38.00
#3 Amber Blankets	24.75	25.25	24.25	24.00	23.75
Thin Brown Crepe	21.75	23.25	22.50	22.00	21.75
Flat Bark	18.25	19.25	19.00	19.25	19.25

The spot price for #1 Ribbed Smoked Sheets started the period at a high of 31.00¢, fell to a low of 27.75¢ on September 9, and closed at 28.00¢ on September 15. Spot prices for #2 and #3 smoked sheets showed corresponding movement at differentials of 0.75 and 1.50¢, respectively, from the #1 sheet price. Latex crepe prices dropped from 39.50¢ at the start of the period to 38.50¢ at the close. Price declines for other grades over the period were as follows: #3 Amber Blankets, from 25.25 to 23.75¢; and Thin Brown Crepe, from 23.25 to 21.75¢. Flat Bark stayed in the 19.00-19.25¢ range.

COMMODITY EXCHANGE
WEEK-END CLOSING PRICES

Futures	June 28	July 26	Aug. 23	Aug. 30	Sept. 6	Sept. 13
Dec.	29.85	28.20	28.05	27.00	26.25	25.90
Mar.	28.35	27.30	27.15	26.00	25.50	25.00
May	27.75	26.75	26.70	25.65	25.25	24.65
July	27.15	26.35	26.45	25.40	25.00	24.50
Sept.	....	....	26.30	25.20	24.90	24.50
Total weekly sales, tons	4,630	2,080	1,730	3,750	4,240	3,620

December futures prices started the period at 28.40¢, fell to a low of 25.65¢ on September 8, and closed at 26.15¢ on September 15. The quiet futures market was reflected in the low sales figures; only 5,480 tons were sold during the second half of August, making a total for the month of 10,230 tons. The improvement in market activity during the first half of September is shown by the 7,900 tons sold during this period.

In the synthetic rubber market, the RFC announced new selling prices for oil and oil-black masterbatch GR-S polymers effective August 1. The new prices, in cents per pound, are as follows:

Oil Masterbatches

X-628, -693	19.50
X-654, -700, -712, -713, 714, 715	19.25
X-717, -718	18.00
X-706, -716	17.75
X-709	16.75

Oil-Black Masterbatch

X-629	16.75

Latex

A TIGHT *Hevea* latex supply situation developed during the period from August 16 to September 15. Since a response from the Far East to an increased United States demand takes from three to four months, it is apparent that any improvement in the present situation is virtually impossible before January. Prices for spot latex range from 39.5-41.5¢ a pound, dry weight, in tank-car quantities; while futures prices for the October-December period range from 37.5-40.0¢ a pound, dry weight.

As would be expected from the tight supply situation, *Hevea* latex prices are quite firm and show a steadily widening differential over dry rubber prices. Offerings for the first quarter of 1953 are being made on the basis of differentials which prevailed just after government decontrol. These prices are quite attractive, therefore, and considerable buying interest is developing.

Preliminary estimates for *Hevea* latex in July are as follows: imports, 3,121 long tons, dry weight; consumption, 3,341 long tons; and month-end stocks, 8,530 long tons.

GR-S latex prices continued unchanged at 21.5-26.0¢ a pound, dry weight, depending on type. June production of GR-S latices amounted to 3,537 long tons, dry weight; imports, 258 long tons; consumption, 3,486 long tons; and month-end stocks, 3,927 long tons. Estimates for July are: production, 2,593 long tons; imports, 200 long tons; consumption, 2,510 long tons; month-end stocks, 4,449 long tons.

Neoprene latex figures for June follow: production, 544 long tons, dry weight; consumption, 559 long tons; and month-end stocks, 981 long tons. Estimates for July are: production, 564 long tons; consumption, 451 long tons; and month-end stocks, 1,043 long tons.

Statistics for nitrile rubber latices in June show: production, 336 long tons, dry weight; consumption, 266 long tons; and month-end stocks, 591 long tons. July estimates are: production, 316 long tons; consumption, 181 long tons; and month-end stocks, 573 long tons.

SCRAP RUBBER

THE scrap rubber market continued dull, with activity at a low level during the period from August 16 to September 15. There was some demand for truck and bus tires, but dealers were reluctant to make any shipments without including some unwanted auto tires. Red auto tube scrap showed some movement during the period, but this activity is believed to be only temporary in nature. Export business continued on the slow side, and no improvement is expected within the next few months. Scrap dealers are somewhat more optimistic over the outlook for the immediate future because of the improvement in reclaimed rubber demand.

No changes in scrap rubber prices occurred during the period. Following are dealers' selling prices for scrap rubber in carload lots, delivered to mills at the points indicated:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$9.00	$12.00
S. A. G. auto tires	Nom.	Nom.
Truck tires	Nom.	12.00/ 13.00
Peelings, No. 1	Nom.	42.50/ 45.50
2	Nom.	23.00
3	Nom.	20.00
	(¢ per Lb.)	
Auto tubes, mixed	2.75/ 3.00	2.75/ 3.00
Black	3.00	3.75
Red	7.25/ 7.75	7.25/ 7.75
Butyl	1.75/ 2.00	1.75/ 2.00

RECLAIMED RUBBER

THE reclaimed rubber market showed some improvement during the period from August 16 to September 15. This improvement resulted from increased demand for reclaim by tire manufacturers who have begun production for the 1953 automobile models. Since it is estimated that at least 5,000,000 new autos will be produced in 1953, the immediate outlook for reclaim is optimistic. Renewed interest in reclaim is also being shown by hard rubber goods manufacturers. Despite the pick-up in demand, there were no changes in reclaim selling prices during the period.

Final June and preliminary July statistics on the domestic reclaimed rubber industry are now available. June figures follow: production, 21,079 long tons; imports, 100 long tons; consumption, 21,850 long tons; exports, 903 long tons; and month-end stocks, 38,973 long tons. Preliminary figures for July are: production, 16,405 long tons; imports, 113 long tons; consumption, 18,439 long tons; exports, 991 long tons; and month-end stocks, 36,347 long tons.

COTTON AND FABRICS

NEW YORK COTTON EXCHANGE
WEEK-END CLOSING PRICES

Futures	June 28	July 26	Aug. 23	Aug. 30	Sept. 6	Sept. 13
Dec.	36.76	36.70	38.37	38.84	39.20	39.28
Mar.	36.62	36.62	38.25	38.72	39.16	39.22
May	36.43	36.45	38.07	38.54	38.90	39.05
July	38.08	36.04	37.60	38.00	38.43	39.54
Oct.	34.56	34.59	35.78	36.05	36.25	36.25
Dec.	34.35	34.38	35.55	35.83	36.06	36.06

ERRATIC trading and relatively narrow price changes characterized the cotton market during the period from August 16 to September 15. Demand was spotty and concentrated on spot or nearby deliveries. The general tenor of prices was firm and rising in view of lower crop estimates. The government estimate of September 8 predicted a total crop of 13,889,000 bales, as compared with 15,144,000 bales last year. If substantiated, this crop is expected to reduce the carryover at the end of this season to about the same low level as that of last year. Since the left-over stocks will consist mainly of low grades, a growing tightness in supplies of better grades can be expected.

The 15/16-inch middling spot price began the period at 40.20¢, dipped to a low of

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY AND SUPPLIES FOR SALE (Continued)

FOR SALE: 1—20 X 48" RUBBER MILL, M.D.; 1—16 X 42" Rubber Mill; 1—Farrel-Birmingham Self-Contained 6" x 13" 3-roll Laboratory Calender, m.d.; 4—Bolling 18 x 18" 5—opening Hydraulic Presses; 2—Royle Tubers, #½ & #4. Also other sizes Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters. Send us your inquiries. Also your list of Idle Equipment. CONSOLIDATED PRODUCTS CO., INC., 13-16 Park Row, New York 38, N. Y. BArclay 7-0600.

FOR SALE: FARREL 16" X 48" AND 15" X 36", 2-ROLL RUBBER mills, also new lab. 6" x 12" & 6" x 16" mixing mills and calenders, & other sizes up to 84". Extruders 1" to 3". Proctor & Schwartz 6-fan, 3-apron conveyor dryer. Baker-Perkins mixers 100, 50, 9 & 4½ gals., heavy-duty double arm. Ball & Jewell & Leominster rotary cutters. Bethlehem 2000-ton 10-opening hydraulic molding press. Large stock hydraulic presses from 12" x 12" to 48" x 48" platens from 50 to 2000 tons. Hydraulic Pumps and Accumulators, Crushers, Churns, Rubber Bale Cutters, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT CO., 90 WEST STREET, NEW YORK 6, N. Y.

FOR SALE: 470 PAIR ASSORTED SIZES PORCELAIN GLOVE forms—straight surgeon finger—brand new—25% off invoice price. Dipping equipment for complete manufacture of 36" drainage tubes—includes form, tanks, hydraulic equipment. Address Box No. 1162, care of INDIA RUBBER WORLD.

1—18" X 52", 2-OPENING, 6-RAM, STEAM PLATEN PRESS, cast steel, single unit crosshead. AMERICAN BILTRITE RUBBER CO., INC., Trenton 2, N. J.

MACHINERY AND SUPPLIES WANTED

WANTED—TO EXPEDITE PRODUCTION—RUBBER MAKING machinery including Banbury Mixers, Heavy-Duty Mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider a set-up plant now operating or shut down. When offering, give full particulars. P. O. Box 1351, Church Street Sta., New York 8, N. Y.

WANTED: TIRE SKIVING MACHINERY. C. BUNKER, BLOOMingdale, Ill.

ACCUMULATOR AND PUMPS

1—7" x 6' inverted accumulator, Mf'd. by Chas. Elmes Eng. Wks., 37" dial shell. Takes 11,000# ballast for 300# W.P. Max. Work. height 15'-11", 2" pipe conn. to spindle, new 1943.

2—Worthington 4½" x 6" vert. triple single-acting pumps. 300# P.S.I., motor drive, less motors, bronze trimmed, new 1943.

DALTON SUPPLY CO.

2829 Cedar St. Phila. 34, Pa.

For SALE

1—Banbury #9 Mixer.
1—Banbury #1 Mixer with 50 HP Motor.
1—Baker Perkins Laboratory Size 6, Class BB, 2 Gal. Internal Rubber Mixer.
2—Thropp 2-Roll Rubber Mills, 18" x 50".
1—Thropp 2-Roll Rubber Mill, 14" x 30".
1—Thropp 3-Roll Rubber Calender, 18" x 54".
1—Royle #5 Rubber Strainer with 125 HP Motor & Drive.
1—Ball & Jewell Stainless Steel #0 Rotary Cutter with Motor & Starter.
1—Paul O'Abbe #2 Master Rotary Cutter with Ball Bearings.
1—Adamson Vulcanizer, 2' x 12', with quick opening door, 150 lbs. W. P.
5—Cleveland Worm Gear Reducers, Size 800 AT, Series 24B, 1200 RPM, 8-1 Ratio, 75 H. P.

R. GELB & SONS, INC.
UNION, N. J. UNIONVILLE 2-4900

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MILLS, CALENDERS, TUBERS
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HYD. PRESSES, PUMPS, MIXERS
CUTTING MACHINES, PULVERIZERS

UNITED RUBBER MACHINERY EXCHANGE
183-189 ORATON ST. CABLE "URME" NEWARK 4, N. J.

39.55¢ on August 22 and 25, rose to a high of 40.75¢ on September 8, and closed at 39.70¢ on September 15. Similar movement was shown by futures prices, with December futures recording a low of 38.37¢ on August 22 and a high of 39.97¢ on September 8.

Fabrics

Renewed activity and a generally stronger price tone were evident in all types of industrial goods during the first half of September, after the lull throughout August. Trading in wide goods, including ducks, sateens, and drills, was on a substantial scale, with deliveries into November. Chafer fabrics and hose and belting ducks were in better demand as rubber goods manufacturers began to swing away from the month-to-month buying policies they had employed during the past few months. Headlinings and other fabrics for the automobile industry showed heavy purchases as the industry began to prepare for the production of new model autos. Trading in print cloths was limited because of the scarcity of spot goods, but good business was done for October-December deliveries.

Cotton Fabrics

Drills			
59-inch 1.85-yd.	*yd.*	$0.39	$0.40
2.25-yd.		.34	.35
Ducks			
38-inch 1.78-yd S. F.	*yd.*	.3675	
2.00-yd D. F.		.33	
51.5-inch, 1.35-yd, S. F.		nom.	
Hose and belting		.73	
Osnaburgs			
40-inch 2.11-yd.	*yd.*	.25	.255
3.65-yd.		.16	
Raincoat Fabrics			
Print cloth, 38½-inch, 64x60	*yd.*	.16	.1625
Sheeting, 48-inch, 4.17-yd		.22⅜	
52-inch 3.85-yd		.245	

Chafer Fabrics

14-oz. sq. yd. Fl	*lb.*	$0.79	
11.65-oz. sq. yd. S		.71	
10.80-oz. sq. yd. S		.73	
8.9-oz. sq. yd. S		.765	

Other Fabrics

Headlining, 68-inch 1.35-yd., 2-ply	*yd.*	nom.	
68-inch, 1.25-yd. 2-ply		.67	
Sateens, 53-inch 1.32-yd		.60	$0.61
58-inch 1.21-yd		.655	/ .66

Tire Cords

K. P. std., 12-4-2	*lb.*	.85	

RAYON

AUGUST shipments of all types of rayon by domestic producers totaled 114,400,000 pounds, an increase of 3% over July and 15% over August, 1951 figures. This total was the highest for any month since March, 1951. Producers' stocks declined for the fifth consecutive month and stood at 72,700,000 pounds August 31.

Production of viscose high-tenacity yarn during August was 35,900,000 pounds, or 98% of estimated capacity. Shipments of this yarn, both domestic and export, amounted to 34,400,000 pounds, and stocks on August 31 were 5,700,000 pounds.

No changes in viscose tire yarn and fabric prices took place during the period from August 16 to September 15, and current prices follow:

Rayon Prices

Tire Yarns

1100/ 480	$0.63
1100/ 490	.62
1150/ 490	.62
1650/ 720	.62
1650/ 980	.61
1900/ 980	.61
2200/ 960	.61
2200/ 980	.60
4400/2934	.63

Tire Fabrics

1100/490/2		$0.72
1650/980/2	$0.659	/ .75
2200/980/2		.685

Estimated Automotive Pneumatic Casings and Tube Shipments, Production, Inventory, July, June, 1952; First Seven Months 1952, 1951

	July, 1952	% of Change from Preceding Month	June, 1952	First Seven Months, 1952	First Seven Months, 1951
Passenger Casings					
Shipments					
Original equipment	985,987		2,190,544	13,172,737	16,742,957
Replacement	5,057,833		5,569,099	27,500,332	20,351,117
Export	72,076		74,652	382,569	376,736
Total	6,115,896	−21.94	7,834,295	41,055,638	37,470,810
Production	5,977,971	− 1.47	6,067,076	42,541,073	37,012,006
Inventory end of month	8,544,855	− 1.21	8,649,809	8,544,855	2,538,650
Truck and Bus Casings					
Shipments					
Original equipment	200,382		426,166	3,071,691	3,333,861
Replacement	787,086		686,619	4,749,085	5,764,038
Export	44,611		55,435	529,078	441,102
Total	1,032,079	−11.65	1,168,220	8,349,854	9,539,001
Production	1,118,940	−13.86	1,298,916	9,665,440	9,859,253
Inventory end of month	3,102,192	+ 2.79	3,017,900	3,102,192	1,047,128
Total Automotive Casings					
Shipments					
Original equipment	1,186,369		2,616,710	16,244,428	20,076,818
Replacement	5,844,919		6,255,718	32,249,417	26,115,155
Export	116,687		130,087	911,647	817,838
Total	7,147,975	−20.60	9,002,515	49,405,492	47,009,811
Production	7,096,911	− 3.65	7,365,992	52,206,513	46,871,259
Inventory end of month	11,647,047	− 0.18	11,667,709	11,647,047	3,585,778
Passenger Including Motorcycle and Truck and Bus Tube					
Shipments					
Original equipment	1,185,084		2,609,527	16,237,951	20,081,506
Replacement	3,227,837		3,323,260	19,737,835	20,212,699
Export	94,034		107,449	692,100	479,413
Total	4,506,955	−25.39	6,040,236	36,657,886	40,773,618
Production	4,789,948	−13.47	5,535,555	37,794,579	38,500,171
Inventory end of month	11,221,998	+ 2.26	10,973,997	11,221,998	5,684,678

NOTE: Cumulative data on this report include adjustments made in prior months.
SOURCE: The Rubber Manufacturers Association, Inc., New York, N. Y.

SPE Sections

(*Continued from page 85*)

were distributed through the courtesy of Guy Martinelli, Sylvan Plastics, Inc., and the meeting closed with a drawing for three door prizes contributed by Empire Brushes, Inc.

Miami Valley Section Picnic

The Miami Valley Section, SPE, opened a new year of activities with its annual fall picnic at Old River Park, Dayton, O., on September 4, with 44 members and guests attending. Chester Kruger, National Cash Register Co., again handled arrangements for the picnic, which featured a miniature golf tournament and other sports during the afternoon, followed by a picnic supper. There was also a showing of the color-sound film, "The Du Pont Story." First prize in the golf tournament went to Charley Selz, Kurz-Kasch, Inc.; while Bob McCullough, Plastic Research Products Co., won the booby prize for high score.

Section President Merle F. Nelson, Plastic Moldings Corp., announced the appointment of John R. White, Buckeye Molding Co., as treasurer and director of the Section, replacing Paul A. MacPhee, National Cash Register, who had accepted a new position with the Southwest Research Institute. Mr. MacPhee was honored by the entire chemical research personnel of National Cash Register at a special luncheon on September 12 at Old River Park.

Chicago Golf Outing

The third and final joint golf outing of the Chicago Section, SPE, and Midwest Chapter, SPI, was held August 28 at Rolling Green Country Club, Arlington Heights, Ill. More than 100 members and guests participated in the golf tournament and the dinner which followed, and some 85 prizes were distributed to the best golfers. Arrangements were handled by Warren Cooper, Tennessee Eastman Corp., assisted by Maurice Meltzer, Service Plastics Co.

Polyethylene Carboy Oked

THE Interstate Commerce Commission has approved use of the polythylene carboy as a package for hydrofluoric acid not more than 60% in strength. Specification ICC-IF has been issued to cover the plastic carboy and is expected to facilitate approval of the carboy for packaging other suitable chemicals.

The 6½- and 13-gallon plastic bottles are blow molded by Plax Corp., West Hartford, Conn., and assembled with an outer plywood jacket to form the complete carboy unit by Seymour & Peck Division, Greif Bros. Cooperage Co., Rahway, N. J. The units were first introduced in March, 1952.

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U. S. Imports, Exports, and Reexports of Crude and Manufactured Rubber

Imports for Consumption of Crude and Manufactured Rubber

	May, 1952 Quantity	Value
UNMANUFACTURED, Lbs.		
Crude rubber	124,910,577	$45,898,163
Latex	7,636,824	3,140,619
Guayule	33,800	7,644
Balata	127,373	32,488
Jelutong or Pontianak	205,978	141,257
Gutta percha	57,295	27,853
Synthetic rubber	3,566,453	944,308
Crude chicle	86,983	50,125
Reclaimed rubber	281,005	20,879
Scrap rubber	1,913,197	77,135
TOTALS	138,819,485	$50,340,471
MANUFACTURED		
Rubber tires		
Auto, etc. *no.*	4,914	$228,418
Bicycle *no.*	2,826	2,710
Other *no.*	199	6,536
Inner tubes		
Auto, etc. *no.*	138	319
Footwear: boots *prs.*	12,046	36,461
Shoes and overshoes *prs.*	32,784	18,075
Rubber-soled canvas shoes *prs.*	3,494	2,183
Athletic balls: golf *no.*	7,200	2,063
Tennis *no.*	47,208	11,401
Other *no.*	15,816	719
Toys	.....	29,763
Hard rubber goods		
Combs *no.*	18,720	2,363
Other	.....	2,188
Rubberized printing blankets *lbs.*	444	1,017
Rubber and cotton packing *lbs.*	3,647	7,068
Gaskets and valve packing	.....	3,203
Belting *lbs.*	8,123	13,264
Hose and tubing	.....	8,588
Drug sundries	.....	16,949
Nipples and pacifiers *gr.*	1,650	3,318
Instruments *doz.*	608	3,136
Other rubber products	.....	212
Gutta percha manufactures *lbs.*	1,880	1,930
Synthetic rubber products	.....	360
Other soft rubber goods	.....	90,672
TOTALS	.....	$492,916
GRAND TOTALS, ALL RUBBER IMPORTS	.....	$50,833,387

Exports of Domestic Merchandise

	May, 1952 Quantity	Value
UNMANUFACTURED, Lbs.		
Chicle and chewing gum bases	348,959	$167,535
Balata, gutta percha, etc.	175	516
Synthetic rubbers		
GR-S type	2,895,272	725,553
Butyl	100	439
Neoprene	1,523,828	606,939
Nitrile type	784,332	421,445
Other	59,556	37,427
Reclaimed rubber	2,414,341	229,232
Scrap rubber	3,209,202	86,856
TOTALS	11,235,765	$2,275,942
MANUFACTURED		
Rubber cement *gals.*	68,080	$111,004
And rubberized fabric *sq. yds.*	99,668	90,568
Clothing	.....	211,465
Footwear		
Boots and shoes *prs.*	15,191	58,476
Rubber soled canvas shoes *prs.*	23,322	42,525
Heels *doz. prs.*	44,710	55,896
Soles, soling, and tophft sheets *lbs.*	690,313	196,656
Gloves and mittens *doz. prs.*	12,918	53,758
Drug sundries	.....	176,958
Toys, balls, novelties	.....	60,964
Hard rubber goods		
Battery boxes *no.*	106,595	85,393
Other	.....	19,000
Rubber tires and casings		
Truck and bus *no.*	63,568	3,529,919
Auto and motorcycle *no.*	44,704	587,658
Aircraft *no.*	1,470	91,037
Off-the-road *no.*	14,706	2,208,185
Farm tractor *no.*	8,344	386,954
Farm implement *no.*	4,941	55,559
Other *no.*	16,431	78,238
Inner tubes: auto *no.*	31,384	70,895
Truck and bus *no.*	32,070	185,125
Aircraft *no.*	1,775	11,481
Other *no.*	16,101	75,412
Solid tires: truck and industrial *no.*	3,537	62,986
Tire repair materials		
Camelback *lbs.*	903,592	312,461
Other *lbs.*	376,210	301,446
Tape, except medical and friction *lbs.*	57,565	52,599
Belting		
V-type fan belts *lbs.*	83,778	113,020
Transmission		
V-belts *lbs.*	120,726	282,500
Flat belts *lbs.*	82,342	120,105
Conveyor and elevator *lbs.*	54,940	57,481
Other *lbs.*	19,851	12,980
Hose		
Molded and braided *lbs.*	427,865	353,585
Wrapped and hand built *lbs.*	201,646	211,120
Other hose and tubing *lbs.*	127,736	167,522
Packing		
Sheet type *lbs.*	43,114	30,776
Other *lbs.*	193,901	239,234
Tiling and flooring *lbs.*	127,277	34,237
Mats and matting *lbs.*	284,955	87,205
Thread: bare *lbs.*	12,491	24,525
Textile covered *lbs.*	8,148	31,889
Compounded rubber for further manufacture *lbs.*	1,498,050	462,848
Other rubber manufactures	.....	550,979
TOTALS	.....	$11,952,124
GRAND TOTALS, ALL RUBBER EXPORTS	.....	$14,228,066

Reexports of Foreign Merchandise

	May, 1952 Quantity	Value
UNMANUFACTURED, Lbs.		
Crude rubber	290,996	$150,568
Balata, gutta percha, etc.	11,497	6,900
Synthetic rubber, GR-S	8,758	4,829
TOTALS	311,251	$162,297
MANUFACTURED		
Drug sundries	.....	$648
Rubber toys, balls, novelties	.....	100
TOTALS	.....	$748
GRAND TOTALS, ALL RUBBER REEXPORTS	.....	$163,045

SOURCE: Bureau of the Census, United States Department of Commerce, Washington, D. C.

United States Rubber Industry Employment, Wages, Hours

	Prod. Workers 1000's	Ave. Week Earnings	Ave. Week Hours	Ave. Hour. Earnings	Consumers Price Index
All Rubber Products					
1939	121	$27.84	39.9	$0.745	99.4
1949	186	57.79	38.3	1.509	170.2
1950	203	64.42	40.9	1.575	171.9
1951	219	68.70	40.6	1.692	185.6
May	220	68.56	41.3	1.660	185.4
June	220	71.27	41.9	1.701	185.2
July	217	70.81	41.0	1.727	185.5
Aug.	218	69.52	40.7	1.708	185.5
Sept.	218	70.18	40.9	1.716	186.6
Oct.	215	68.67	40.3	1.704	187.4
Nov.	219	69.46	40.5	1.715	188.6
Dec.	219	73.91	41.2	1.794	189.1
1952					
Jan.	218	74.19	40.9	1.814	189.1
Feb.	215	73.31	40.5	1.810	187.9
Mar.	216	73.40	40.6	1.808	188.0
Apr.	213	71.68	39.8	1.801	189.0
Tires and Tubes					
1939	54.2	$33.36	35.0	$0.957	
1949	83.6	63.26	36.4	1.738	
1950	87.8	72.48	39.8	1.821	
1951	90.8	77.93	39.6	1.968	
May	88.3	75.92	39.4	1.927	
June	89.9	82.44	41.7	1.977	
July	90.0	83.67	41.4	2.021	
Aug.	91.5	82.07	41.2	1.992	
Sept.	92.4	81.64	40.9	1.996	
Oct.	89.8	78.76	39.9	1.974	
Nov.	94.8	80.27	40.5	1.982	
Dec.	95.4	86.26	41.0	2.104	
1952					
Jan.	94.4	86.99	40.9	2.127	
Feb.	94.2	85.75	40.6	2.112	
Mar.	93.9	85.72	40.8	2.101	
Apr.	94.2	82.83	39.9	2.076	
Rubber Footwear					
1939	14.8	$22.80	37.5	$0.607	
1949	21.6	48.94	38.6	1.268	
1950	20.6	52.21	40.1	1.302	
1951	25.3	57.81	41.0	1.410	
May	25.4	61.48	42.9	1.433	
June	25.7	59.98	42.3	1.418	
July	24.8	54.68	39.0	1.402	
Aug.	25.2	57.04	40.8	1.398	
Sept.	25.3	55.94	40.1	1.395	
Oct.	25.5	56.16	40.0	1.404	
Nov.	25.6	56.64	40.2	1.409	
Dec.	25.5	59.95	40.7	1.473	
1952					
Jan.	25.4	60.27	40.1	1.503	
Feb.	24.7	60.46	39.8	1.519	
Mar.	24.2	61.51	40.2	1.530	
Apr.	22.0	59.42	39.3	1.512	
Other Rubber Products					
1939	51.9	$23.34	38.9	$0.605	
1949	80.9	54.38	40.1	1.356	
1950	94.3	59.76	42.2	1.416	
1951	102.9	63.26	41.4	1.528	
May	106.0	64.09	42.5	1.508	
June	104.7	64.47	42.0	1.535	
July	102.2	63.29	41.1	1.540	
Aug.	101.2	61.42	40.3	1.524	
Sept.	100.2	63.06	41.0	1.538	
Oct.	99.4	62.68	40.7	1.540	
Nov.	98.2	62.36	40.6	1.536	
Dec.	97.9	65.45	41.5	1.577	
1952					
Jan.	97.9	65.63	41.2	1.593	
Feb.	96.3	64.43	40.6	1.587	
Mar.	97.7	64.48	40.5	1.592	
Apr.	96.9	63.76	39.9	1.598	

SOURCE: BLS, United States Department of Labor, Washington, D. C.

United States Rubber Statistics — June, 1952

	New Supply Production	Imports	Total	Distribution Consumption	Exports	Month. End Stocks
Natural rubber, total	0	62,821	62,821	33,035	156	64,105
Latex, total	0	4,425	4,425	3,911	0	8,890
Rubber and latex, total	0	67,246	67,246	36,946	156	72,995
Synthetic rubbers, total	*57,286 †6,754	2,293	66,333	66,203	1,139	151,324
GR-S types‡	*51,796 †339	2,111	53,946	54,939	451	116,646
Butyl	*5,490	182	5,672	5,812	0	21,580
Neoprene‡	*5,469	0	5,469	4,286	492	9,383
Nitrile types‡	†1,246	0	1,246	1,166	196	3,715
Natural rubber and latex, and synthetic rubbers, total	64,040	69,539	133,579	103,149	1,295	224,319
Reclaimed rubber, total	21,079	100	21,179	21,850	903	38,973
GRAND TOTALS	85,119	69,639	154,758	124,999	2,198	263,292

*Government plant production.
†Private plant production.
‡Includes latices.
SOURCE: Rubber Division, NPA, United States Department of Commerce, Washington, D. C.

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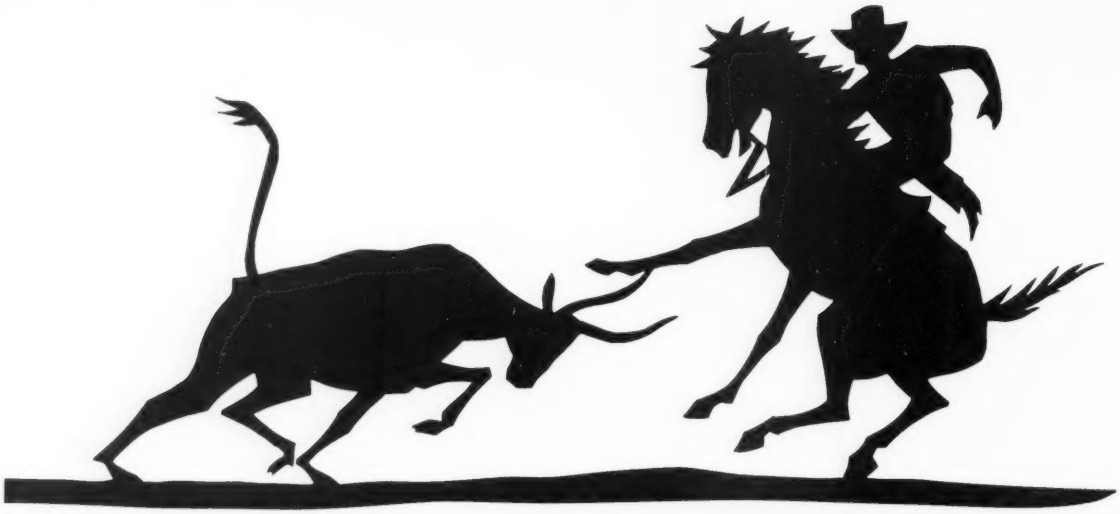

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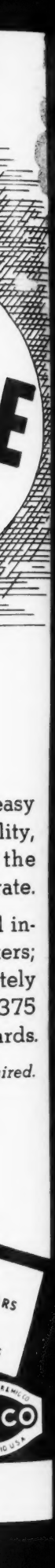
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